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CHANGES for advertisements should be in this office by Friday noon for the following week's issue.
NEW ADVERTISEMENTS should be in the office not later than Monday noon to insure publication in that week's issue.

On May 30, at Hartford, Ct., a nine-year-old boy, named Arthur Budds, got hold of the transmission-line cables which bring in power for the electric light company in that city at a pressure of 10,000 volts alternating (60 cycles), and received a tremendous shock, sufficient to burn his hands very severely and to render him apparently dead when he was finally rescued. After working over him for some time with artificial respiration he regained consciousness and began to breathe naturally. At the time this is written he is progressing steadily toward complete recovery. It will be noted that he got a shock over five times as powerful as that which is used in this state for the execution of grown-up criminals. Comment further is entirely unnecessary.

INDEPENDENT TELEPHONY.

That branch of the telephone business of the United States which is known as Independent has attained such considerable proportions as to make it one of the largest industries in the country. At the same time, every indication points to its increase, both in investment represented and in volume of business done. The industry to-day shows an investment of about $125,000,000, and no less than 1,400,000 telephones are connected to the great number of exchanges operated by independent owners.

When the fundamental patents on electric telephones expired a considerable number of manufacturers entered the field, and, by reason of the continual expiration of various device patents, the independent companies were soon able to secure apparatus of excellent quality, capable of giving exceedingly good results. Perhaps it is fair to say now that the class of construction adopted by these companies in the early years of the movement was not the best; as indeed, it could not be, seeing that there was a gap of seventeen years, representing the length of life of patents, between current practice and that they were able to adopt. Nevertheless, it required only a few years to bring the engineering features of the competing exchanges up to a standard such that a comparison with older institutions could be met without fear. The independent manufacturing companies worked with energy and intelligence and accomplished results of almost incredible excellence in the face of the greatest difficulties.

In a few years such sections of the country as the states of Ohio, Indiana and Illinois, for example, have been practically covered with the lines of the independent companies, and hundreds and even thousands of exchanges have been put into operation, bringing the benefits of cheap telephone service practically within reach of all the inhabitants of those states. There is no doubt that cheapness of service, which has always distinguished the independent exchanges, has been the largest contributing factor to their growth. But there has been also another element of importance in the fact that, in most cases, the exchange operating companies are local enterprises identified with the people of the places that they serve.

To-day, in examining the independent telephone field, the observer is struck with the fact that very great numbers of corporations engaged in this business have practically identical interests which are not competitive, and that whatever their local conditions may be there is a strong necessity for cooperation among them, especially in the construction of intercommunicating lines between the various exchanges. While the value of a telephone is very much greater for local service than for long-distance service, still, the latter is an absolutely essential feature of telephone exchange operation to-day; and that exchange, other things being equal, which can offer the best and most widespread long-distance service will secure the most customers and do the largest business. This point has been lately appreciated to a wide extent by these companies and the last year was marked by a very large increase in the number and length of toll lines connecting the various exchanges. In many cases these toll lines are operated by corporations independent of the telephone exchange companies and the majority of them are admirably constructed and excellent lines.

The engineering feature that immediately impresses itself in this connection is the necessity for standardization of toll-line systems and apparatus. This, together with the exceedingly vexed and difficult question of proper schedules for telephone toll-line charges, will doubtless be discussed at the forthcoming convention of the Independent Telephone Association of the United States. It is to be hoped that in the matter of devising an equitable and systematic method of charging for the

use of toll lines some progress will be made, as this point is one of great importance and has a vital influence upon the relation of the companies concerned to the general public.

The one lesson that has been learned by the experience of the past five years has been that good engineering in telephone construction pays and pays well. Where the independent companies have failed, the trouble may generally be ascribed to bad engineering, too cheap a service, or an attempt at too great economy in construction. The telephone business is not unlike other electrical enterprises, but perhaps more than in any other it shows substantial earnings upon money well invested in good apparatus and proper design. The fatal mistake of trying to save money in the initial cost of exchanges, leading invariably to bad work and the use of poor materials, has been made too often; but it is pleasant and satisfactory to notice that it is being made very little to-day. The standard of excellence set by recent independent telephone construction is of the highest, and some of these exchanges in the United States represent the foremost advance of the art of telephone engineering.

The future of the independent companies seems bright. They have the advantage of being close to the people and of having a large following and many friends, due to their small prices for service and the general excellence of the service they render. Whenever they shall be able to construct a satisfactory system of intercommunicating long-distance lines there is no doubt that the scope of their operations will be greatly extended. At any rate, the movement itself is a hopeful sign of progress in a much-desired direction. It is not chimerical to look forward to the day when the telephone will be practically universal, and when it will be possible for any person, in this country at least, to communicate easily with any other by telephone. To this excellent end the work of the independent concerns has rapidly tended and the signs of the vigorous growth and rapid progress of this movement should be welcomed, not only in the electrical fraternity itself but by the general public at large, which is, after all, the greatest beneficiary of any improvement in telephony or other means of rapid communication.

THE HUMAN FACTOR.

Even a casual examination of the records of recent accidents connected with such engineering installations as railways, power stations and the like, shows that, in the very large majority of cases, they have been caused, not by failure of the machinery or of automatic apparatus, but by some such lack of intelligence in operation as is shown when danger signals are disregarded or inattention is exhibited by those in charge of powerful agencies. This is particularly the case in the operation of railways, whether the motive power used be steam or electricity. The development of railway signal apparatus has been at least equal to the development of other railway adjuncts and has grown to be a large industry, while the art itself is thoroughly developed and has reached a point of high excellence; but even with the perfected signal systems in use to-day there is in most of them a survival of the human factor which may render the most elaborate and perfect signal system impotent and of no value.

In the case of a steam railway, for example, using electric block signals and semaphores, with danger lights, etc., at night, the whole interlocking so as practically to eliminate accidents due to misunderstanding or incompetence on the part of switchmen, there is still no real connection between the signal itself and the moving train other than the eyesight, intelligence and judgment of the crew of the locomotive. The semaphore standing at danger, or the red light, are not in themselves protections to the passenger, but are simply indications upon which the intelligent man must act, and which, if he disregards them, might as well not be there.

It seems that, at least in the public estimation, the question of electrical operation of main-line railways is bound up with that of high-speed running. We look forward to the development of such railways very confidently and feel a certainty that the speeds of trains will be increased and a certain element of danger always present in railway operation will in this way be made greater. If the eye and the judgment of the motorman were always perfect the present carefully elaborated block signal system would be sufficient for the entire protection of trains, but the electric equipment offers an opportunity to create an actual physical connection between the moving train and the signal that would really eliminate the human factor, so far as the motorman is concerned, and give us practically perfect automatic protection.

If the setting of the signal at danger also disconnected the track conductors from the source of current, a train would perforce have to stop at a signal because it could get no further. The number and magnitude of trolley car accidents, especially on high-speed interurban lines, seem to point the way to the necessity for a signal system that shall supplement its indications by actual handling of the power supply, so that a sleepy, drunken or careless motorman may not be in a position to wreck his car and impose a burden of calamity and cost upon the public and the corporation that employs him.

So long as the human factor remains as important as it is the employing corporation is always in danger of loss. It may do its best in selecting skilled and faithful men and may pay the highest prices for them, but it is at the mercy of their physical and moral organisms—things over which no control can be had and which are liable to deterioration and change without notice.

The matter is one of high importance. It can not be argued with any show of correctness that automatic machinery should entirely replace intelligent labor. The point that is here presented as one worthy of careful thought is that automatic machinery should supplement the intelligence of operatives to such a point as to render a failure of that intelligence powerless to inflict damage. The suggestion made is not impossible of execution, and putting it into effect would at least be an insurance against disaster and an argument for increased patronage.

There is a widespread interest in electrical achievements. The general reader finds it of increasing value to him in these progressive days to keep abreast of the work that is being done in the electrical field. The growth of this sentiment is naturally satisfactory to the technical journals.

STORAGE BATTERY TRACTION.

The wide interest that has been created by the description of Mr. Edison's type of storage battery has again attracted attention to the matter of electric traction by means of accumulators. The automobile problem may be considered as one that is worked out and waiting for certain factors which sooner or later will probably be available. If the new type of battery is all that is claimed, it may indeed be said that the automobile problem is practically solved.

But the question of operating cars upon tracks by means of storage batteries is by no means so simple as many regard it. There is no doubt whatever of the ability of a car provided with accumulators and motors to propel itself. There is equally no doubt whatever that under certain conditions (which fortunately are rare) such cars have the advantage over every other variety of self-propelling vehicles; but as a general proposition it may safely be said that wherever the trolley system is possible there is no occasion for the storage battery car. The reason for this is perfectly evident and is found in the fact that, even with a perfect storage battery, which we shall not see in this life at any rate, the cost of transporting the battery itself must always be borne.

There can be little doubt in the minds of those who have closely studied the engineering features of electric traction that the accumulator is of vital importance in traction work—provided it is installed in the generating station or in substations and not on the moving cars. Only in the streets of the greater cities is there any real ground for objection to the overhead trolley, and in these the traffic is so dense and the patronage is so large that dividends may be earned upon conduit systems in which the fixed charge for interest is relatively high. This leaves as a field for the storage battery car practically only certain short and little traveled lines in cities where municipal considerations prevent the installation of an overhead system, and where the underground system would be too expensive in practice. New York city furnishes several examples of such situations in its crosstown lines and here, doubtless, will be found a satisfactory place for the accumulator car.

The value of the storage battery in electric traction service has been too often proved and is too well known to need consideration here. It will be noticed, however, that in all of the history of electric traction there have been, to date, no conspicuous successes of accumulator installations in which the battery is carried around on the moving car; while, on the other hand, there have been very many successful systems installed in which the battery is placed somewhere along the line and used as a flywheel to steady the operation of the system, and as a storehouse of reserve power to tide over times of heavy travel.

No improvement in the storage battery can change the situation as regards the advisability of putting the battery on the car. Every improvement, however, that is made in batteries will tend to increase their use in stationary installations, where they properly belong and where they render service of the highest value and importance. It seems safe to say, therefore, that storage batteries seem destined in the future to play a large and ever increasing part in the operation of electric railways, but that the batteries will not be carried in the cars.

JUNK.

The Metropolitan Street Railway Company, of New York city, has on its hands about $1,600,000 worth of cable machinery which is, to all intents and purposes, as good as it ever was, but which there is no market for and which must be classed as junk. So lately as seven years ago this company installed nearly $1,000,000 worth of cable machinery in one station. Altogether, electrification of the various street railway systems in the Borough of Manhattan, New York city, is estimated to have caused the retirement of no less than $4,000,000 worth of cable machinery.

No more valuable commentary can be made upon the economy and satisfaction of electric traction than that the managements of these railways—men whose business experience has been long and whose intelligence in management is perfectly evident—should willingly sacrifice these vast sums for the purpose of acquiring the new equipment.

THE BUREAU OF STANDARDS.

It is greatly to be hoped, now that Congress has authorized the establishment of a National Bureau of Standards, that this work will be hastened and the Bureau gotten under way at the earliest possible moment. There is a crying need for standards, especially in the electrical business in this country. It is little less than a severe reproach to us that we should have to go to the Reichsanstalt, in Germany, to have our instruments of precision standardized, and that all of the measures that we use in an industry of such gigantic proportions as the electrical business of the United States, are founded on standards over which we have no control and of which we have even no official copies.

In the one matter of photometric standards the new bureau will have its hands full and, if it is intelligently directed, can accomplish a work of the greatest importance and value. The art of photometry is in an absolutely chaotic condition. At present some excellent work is being done, both by the National Electric Light Association and the American Institute of Electrical Engineers, in regard to standard ratings and candle-power measurements of electric lamps. But the cost and labor of this work should not be imposed upon private individuals or corporations. It is clearly a matter well within the province of the general government, and it is urgently to be hoped that no time will be lost in getting to work on this important matter.

WHERE MINUTES COUNT.

The age of electricity has so inured us to marvels that we no longer wonder at things which would have caused a decided sensation only a few years ago. To those of us who were connected with the early days of the electric railway industry and who saw the feeble efforts of the first trolley cars, it gives pause and wonder to consider that the Broadway trolley road—one branch of the great system which operates in New York city—is called upon every night during the theatre season to take care of between 30,000 and 40,000 people who are turned out of the theatres in a single district of the city in about ten minutes.

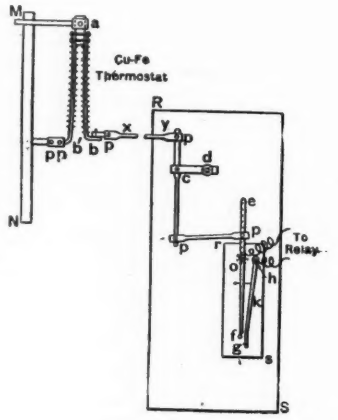
Science Brevities

Hot Wire Instruments—In a lecture before the Italian Electrochemical Association, Sig. C. Olivetto stated that the best material for wires used in hot wire instruments was an alloy of two parts of silver and one of platinum. This alloy combines high resistance with great mechanical strength, and a very large temperature coefficient of expansion. It also has the merit of remaining unoxidized in service.

Incandescent Lamp Filaments — An Austrian patent granted to Herr C. Kellner, of Vienna, is claimed to disclose a process whereby extraordinary light-efficiency is secured. The filament may be made by two methods. In the first, the thread is made, under great pressure, of the powder of an infusible metal such as thorium, which is then oxidized superficially by making it the anode in an oxidizing electrolyte bath. It is stated that the layer of oxide adheres strongly to the metal. The second method is to form the threads from metallic oxides which have the property of becoming incandescent at comparatively low temperatures and using as a cementing material the least possible amount of cellulose dissolved in chloride of zinc. Upon the passage of the current it is stated to become very compact, resembling graphite.

Magnetic Properties of Alloys—In a recent German contemporary Dr. A. Schweitzer describes the results of a number of investigations made to determine the influence of aluminum on the magnetic qualities of cast iron. For the purpose the ballistic galvanometer method was employed, and from the table of results given it is noticeable that the curves of induction become considerably flatter as the proportion of aluminum is increased, and gradually lose the characteristic form of the induction curves for iron. For field strengths down to H = 40 the decrease of the induction is almost parallel to the increased proportion of aluminum. From H = 11.6 to H = 3.6 the induction with 2.45 per cent of admixture of aluminum is greater than the corresponding values for an induction of 1.62 per cent. The curves of the permeability also lose their characteristic form with increased proportions of aluminum; their maximum becomes smaller, and the curves much flatter. The losses due to hysteresis increase with the larger proportions of aluminum, the curves of the losses as a function of the induction becoming increasingly pointed. For an induction B=3,000 the hysteresis losses increase parallel to the increased proportions of aluminum, but for higher inductions they increase at a greater rate relative to the increase of aluminum. The results of the observations may be summed up briefly as follows: Admixtures of aluminum with cast iron effect a decrease of the induction for equal field strengths and an increase of the hysteresis losses for equal inductions. The magnetic qualities of the iron, in fact, are lessened in value.

Automatic Temperature Regulator—Mr. C. T. Knipp has devised an electric temperature regulator which enables one to keep a temperature up to 380 degrees within a fraction of a degree, says the London *Electrician*. The arrangement is shown in the diagram, where *ab, ab'* are two Cu-Fe thermostats clamped with their backs to each other. MN, the main support, carried at its upper end an arm, *Ma*, from which, at *a*, the thermostat was suspended by pivots. The lower end of the arm, *ab'*, was fastened by pivoted connections directly to the support, MN, thus leaving the lower end of *ab* free to move in the plane of the paper, its motion being that due to both branches of the thermostat. This motion, communicated by an aluminum rod, *xy*, to a system of pivoted aluminum levers mounted on a vertical board, RS. The first lever had its fulcrum on a movable support at *c*, which was capable of adjustment up and down by means of a thumbscrew at *d*. The motion of the lower end of this lever was communicated to another lever, *ef*. This lever was mounted on a separate board, *rs*, and both lever and board were pivoted concentrically at *o* to RS. The lower end of *ef* terminated in a platinum ring. Another lever supported on *rs* and pivoted at *h* was held lightly against a stop, *g*, by a delicate spring at *k*. The lever, *hg*, was flattened at its lower end and carried a platinum surface on which *f* played. All of the joints, *p*, were delicately pivoted needle points. The amount of motion at *f* could be varied through a considerable range by adjusting the length of the levers, *op* and *cp*. Wires led from *o* and *h* to a relay which in turn operated an ordinary sounder that controlled a part of the heating current. A great deal of the success of the regulator depends upon the delicacy of the needle-point bearings.



Automatic Temperature Regulator.

Action of Magnetism on Dielectrics—Mr. E. C. Roberts has carried on some careful investigations concerning the behavior of dielectrics in a magnetic field. The behavior of transparent bodies, such as glass, when exposed to a magnetic or electric strain, regarding the passage through them of polarized light, is such as to make it seem likely that their specific inductive capacity is also changed by magnetic action. The method used in experimenting on this problem was based upon the fact that if a condenser is charged, and then suffers any change in the specific inductive capacity of its dielectric, an accompanying change in the potential difference of its charged surfaces will be manifested. The dielectrics studied, which were glass and various forms of hard rubber, were made up as small condensers, tinfoil sheets about two inches square being fastened on opposite sides of a large plate of the material so as to make the leakage path long. In the case of glass the plate was shellaced to further decrease the leakage. These condensers were put into a magnetic field of 1,500 lines per square centimetre, and various different methods used without any effect being observed. The limit of error was stated to be such that a change of one-thirty-five-hundredth part could have been observed.

Electrolytic Sheet Nickel—In a British patent issued to Herr Kugel, of Berlin, is described a method of depositing nickel electrolytically in layers of such thickness that the product is equivalent to rolled nickel in its mechanical properties of toughness, durability and ductility. The method is to acidify the nickel solution with a mineral acid which is unalterable by the electric current. Such an addition usually spoils the bath, causing the deposit to flake off, but this difficulty is overcome by keeping the electrolyte at a temperature over 30 degrees centigrade. Under these circumstances a homogeneous non-crystalline metal is said to be deposited and may be put down in sheets of any required thickness.

THE THEORY OF ALTERNATING DYNAMO ELECTRIC MECHANISMS—XXIX.

BY W. ELWELL GOLDSBOROUGH.

In Figs. 80, 81 and 82 we have conditions presented which make it necessary to develop at the terminals of the incandescent lamp receiving circuit a pressure in excess of the electro-motive force to be derived from the sources of supply. We will consider the necessary leading current, in this particular instance, to be produced by the introduction of either a condenser, as shown in Fig. 81, or a synchronous motor, as shown in Fig. 80, and can proceed with the development of a method for determining the value that this leading current must be given.

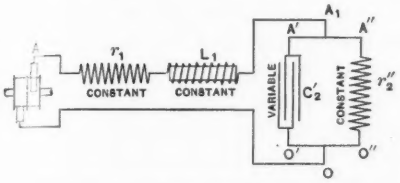


FIG. 81.—ALTERNATING MECHANISMS.

In Fig. 82 lay off the vector OA_1 equal to the electro-motive force needed at the terminals of the receiving circuit. Then from O, with a radius equal to the electro-motive force developed by the generator, describe the arc *abcd*. The distance *a* A_1 equals, therefore, the amount by which the receiver electro-motive force exceeds the generator electro-motive force. The receiver circuit demands a current equal to I_2'' which, in Fig. 82, is shown as the vector OB_2''.

The resistance of the transmission line between the generator and the receiver circuit is r_1, and the resistance electro-motive force needed to set up a current I_2'' in the line is equal to $I_2'' r_1 = OC_a$ of Fig. 82. The inductance of the transmission line is L_1, and the current I_2'' will induce therein a counter electro-motive force having the value

$$L_1 \omega I_2'' = C_a A_a.$$

Consequently, the total line drop due to the current I_2'' will be represented by the vector OA_a. If, now, we lay off from A_1 the vector A_1A^a equal and parallel to OA_a, the resultant of OA_1 and A_1A^a, or the vector distance OA^a, will equal the electro-motive force which the generator should develop were it desired to supply the current I_2'' to the receiver circuit without the aid of the capacity reactance. But an electro-motive force of the value OA^a is not available, and, perforce, the capacity reactance must be used. If, therefore, a capacity reactance circuit of negligible resistance is placed in parallel with the receiver current, a current I_2' will immediately begin to flow, the current being 90° in advance of the vector OB_2''.

Suppose we lay off the new current in length and position equal to OB_2'. The resultant line current will then be represented by the vector OB. From this, it will be evident that if the capacity of the condenser is increased the locus of the line current vector head will be out along the line $B_2''B$. Also, since $I r_1$ varies as I (the line current), both in amount and phase, therefore the heel C_a of the line electro-motive-force triangle will move out along C_aC_b, and, consequently, the extremity of the line electro-motive-force vector OA_b will move at right angles to OA_a from A_a along A_aA_b, since the numerical value of E_1 varies as $I r_1$, and the phase angle between them remains constant. Consequently, with a condenser current equal in value to OB_2', the heel of the line electro-motive-force triangle will move from C_a to C_b, and the head of the vector representing the line electro-motive force will move from A_a to A_b along the line A_aA_b.

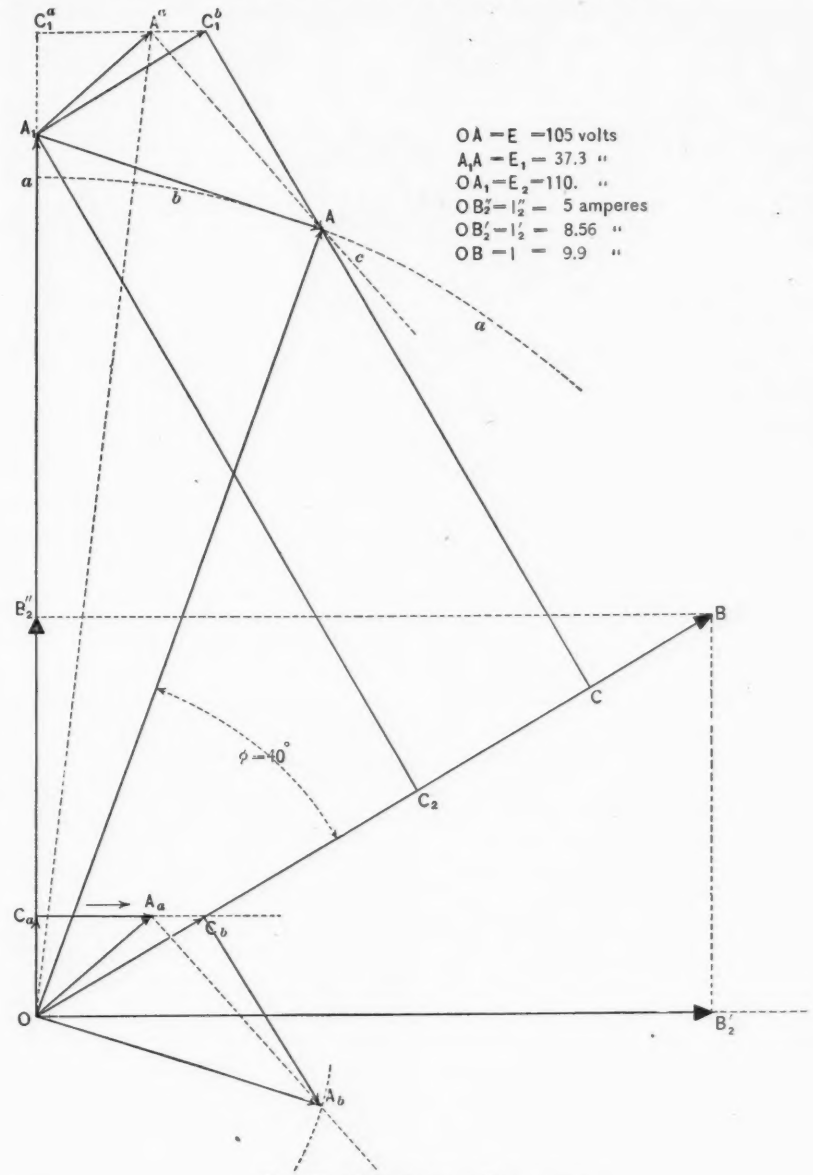


FIG. 82.—ALTERNATING MECHANISMS.

Following this construction we are now in a way to determine the required value of the leading current in the reactive circuit and the final relative phase position of the generator electro-motive force E and the receiver electro-motive force E_2. From A^a lay off the line A^aA parallel to the line A_aA_b until it intersects the circle *abcd* at the point A, and draw the vectors A_1A and OA. We now have OA representing the phase position of the generator electro-motive force; A_1A the phase position of the electro-motive force overcoming the line impedance, and OA_1 the

electro-motive force impressed at the terminals of the receiver circuit. Furthermore, by construction the electro-motive force OA sets up in the system a current OB, which divides at the terminals of the receiver circuit into the currents OB_2' and OB_2'', the values of which are determined by the projection OB on the coordinate lines O *a* and O *z*. By equation (143), page 155,

$$E_c = \frac{I}{C\,\omega}$$

we have that the current flowing in a condenser due to an impressed electro motive force E_2 is equal to

$$I_2' = E_2\,C_2'\,\omega = E_2\,x_2'$$

and from this the capacity of the reactive circuit, which will induce a current of the value OB_2' under stress of an electro-motive force OA_1, is readily determined, and

$$C_2' = \frac{I_2'}{E_2\,\omega}$$

The direct method of application of these principles would be to lay off. in the phase position shown, the line $A_1C_1^a$ equal to I r_1, and, at right angles to this, the line $C_1^aA^a$ equal to I x_1. Then connect the points A_1A^a and project from A^a the line A^aA at right angles to A_1A^a until it intersects the circle *abcd*; now, drawing the line AO locates definitely the phase position of the impressed electro-motive force. Having proceeded with the construction thus far, draw the line A_1A and lay off the line $A_1C_1^b$ lagging behind it by the amount of the angle ϕ_1 equal to

$$\phi_1 = \tan^{-1}\frac{L_1\,\omega}{r_1}$$

From the point B_2'' draw the line $B_2''B$ at right angles to OA_1, and from O extend the line OB parallel to $A_1C_1^b$ until it intersects the line B''B at B. From B draw the line BB_2' parallel to $B_2''O$ until it intersects the line O *z* at the point B_2'. Then, if in this construction OA_1 has been made equal to the receiver electro-motive force, OB_2'' equal to the required receiver current, and OA equal to the generator electro-motive force, OB_2' will be equal to the required condenser current; and

$$C_2' = \frac{(OB_2')}{(OA_1)\,\omega}$$

therefore, equals the necessary equivalent capacity of the auxiliary reactive circuit. The application of this method is limited by the condition that the line A^aA must intersect the circle *abcd*. The practical application of the method becomes important when the line inductance is considerable, since by it a point can be reached where the station electro-motive force OA and the line current OB are in phase; and, under these conditions, the power factor of the distributing system, as a whole, will be unity.

ARC LIGHTING AT THE BEGINNING OF THE TWENTIETH CENTURY.*

BY H. W. HILLMAN.

At the convention held by your association two years ago in New York city, Mr. H. M. Atkinson, president of the Georgia Electric Light Company, Atlanta, read a paper entitled "Alternating-Current Generation and Distribution." The illustration on page 719 was included in Mr. Atkinson's paper as representative of an old type of central station, having 37 units installed for electric arc and incandescent lighting and power purposes. A large number of small size arc machines, shown in the photograph, were belted to and operated from the old familiar line of shafting, which has been so common in connection with arc lighting, from the time the very first arc machines were installed. In concluding his paper, Mr. Atkinson asked three questions as follows:

First. Considering the business within a radius of one-half mile from the station, should we adopt the alternating or direct-current distribution?

Second. Are alternating motors entirely satisfactory for all classes of service, including elevator work?

Third. Assuming alternating current as the source of supply, will the arc lighting of the future be accomplished with direct-current arc machines driven from alternating motors, or with series alternating lamps operated from constant-current transformers?

Your particular attention is called to the last point, because two years have intervened, and at the present writing the lamps which are illuminating the streets of Atlanta are series alternating enclosed arcs, operating from constant-current transformers.

Without entering upon a long discussion, the question might reasonably be asked, what were the reasons for adopting the alternating system of street lighting at Atlanta, instead of direct current?

First. It was the main object of the Georgia company to adopt large units.

Second. Other conditions, aside from arc lighting, encouraged the installation of alternating-current generators.

Third. Having decided to use alternating current as the source of supply, it was plain to see that the series alternating system was cheaper in first cost, higher in efficiency, and would occupy less floor space than a direct-current system, operated from arc machines and alternating motors.

Fourth. As to the character of light from alternating lamps and the acceptance of this light in place of the old nominal 2,000-candle-power open arcs; many careful investigations and tests were made. Twenty-five 7.5-ampere alternating enclosed lamps were installed on the Atlanta streets early in February, 1900, in the business section of the city, where ample opportunity was afforded for comparison with the old style lamps in every particular. This practical test was continued for several months with the result that the light was approved and 650 alternating enclosed lamps replaced the 2,000-candle-power open arcs, pleasing the city officials and the public in general.

It will be of value to dwell on the subject of light somewhat at length, because your association accorded it such prominence at your meeting two years ago, during the discussion which followed Mr. Atkinson's paper. At that meeting the question was asked, "Are we to-day able to state it as an accomplished fact, that arc lighting for street service may be equally as well obtained by the two forms of current, *i. e.*, alternating and direct?" Several questions of this nature were raised, and during the discussion which followed, it was stated that photometric tests proved the alternating arc to be less efficient than the direct current. At this discussion, definite conclusions were not reached, and a committee was appointed to investigate the light from alternating and direct-current arcs, open and enclosed, for the benefit of the members of the association. This committee reported last year at Chicago, but the report referred almost entirely to observations and tests within the laboratory, and more particularly to the relative intensity and distribution of light from direct and alternating enclosed arcs for interior lighting. The committee had not reached the subject of street lighting, because of the extent of the work involved.

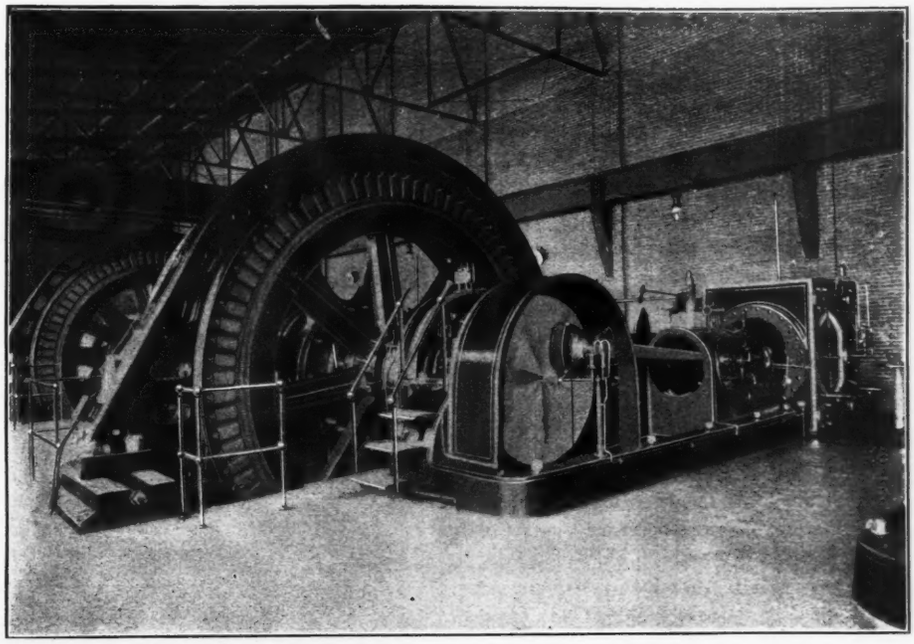
It may, therefore, be of interest to the members, if further evidence is offered, substantiating the claim that arc lighting for street service may be equally as well accomplished by either alternating or direct current.

For six months the Monongahela Light and Power Company has been operating 1,000 alternating lamps in the suburbs of Pittsburgh. They replace 9.6-ampere open arc lamps and speak only words of praise in regard to the satisfactory service secured. The words "satisfactory service" do not refer simply to the electrical and mechanical features of the system, but are meant to give you the impression that the entire service is satisfactory. Effective

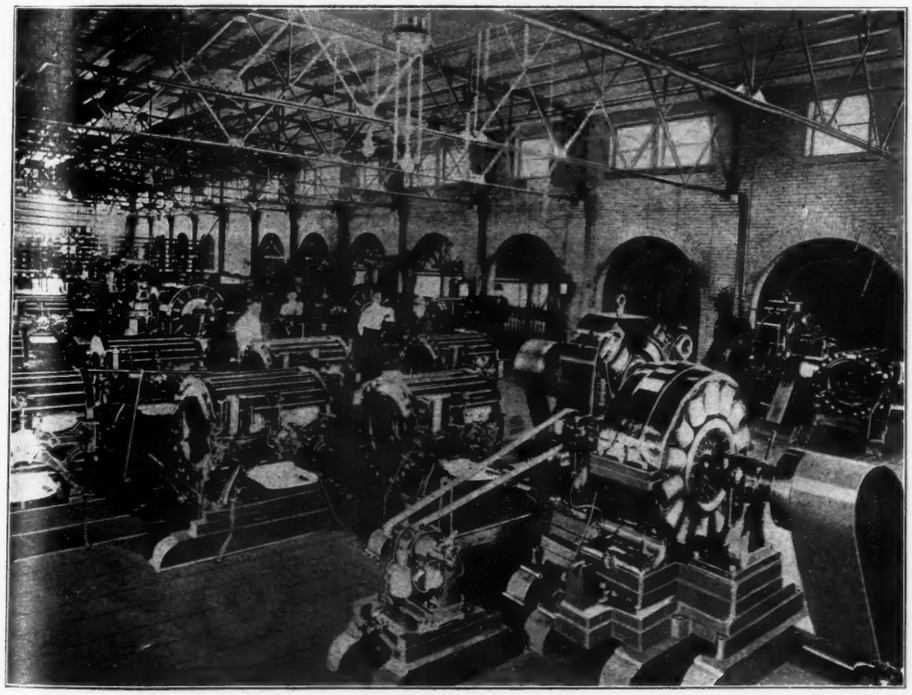
*A paper read before the National Electric Light Association, May 22, 1901.

illumination is secured, which is satisfactory to the city authorities. The system is also satisfactory to the company which furnishes the light. Fourteen 100-light transformers and 1,000 series alternating enclosed lamps complete this arc lighting equipment. Part of the system is operated on 6,000-volt primaries, and part of 2,200-volt; some of the transformers are in the main station, and others in substations. Surely, such installations are of a representative character, and in addition to further evidence referred to later, would indicate that we have reached the conclusion that alternating is as good as direct service for street arc lighting.

Since your discussions two years ago, 50,000 lights capacity of enclosed arcs has been installed for street lighting, of which 30,000 lights capacity is represented by alternating arcs. Enclosed arcs have been adopted by 350 cities, of which 300 have introduced alternating arcs. About 270 cities are operating 6.6-ampere lamps, consuming only 430 watts (average), as compared with about 30 of the 7.5-ampere, consuming 485 watts (average). Your attention is particularly called to this latter point, because it shows that as far as volume of light is concerned, the alternating system has fully met the demand.



Generating Station of Monongahela Power Company.



Old Arc Lighting Station of the Georgia Electric Light Company, Atlanta, Ga.

In fact, while the 7.5-ampere, 485-watt lamp has been available since the system was first introduced, 90 per cent of the cities and towns have adopted the lower energy lamps, consuming only 430 watts. If the limiting feature of the system had been in respect to the volume of light from an alternating lamp, surely the 7.5-ampere system would have been adopted exclusively.

POWER FACTOR.

Since alternating arc lamps came into use, the subject of power factor has frequently been raised, and resulted in lengthy discussions. The multiple type lamp met such a long-felt want, that since its first introduction it has been popular, notwithstanding that it has had a power factor of only 68 per cent to 70 per cent. Exhaustive experimental work has been carried on with a view of increasing this power factor. Such successful results have been secured as to warrant the statement that at no late date—possibly before your next meeting—the alternating multiple lamp will be made with a considerably higher power factor.

The power factor of the series alternating street system has also been a much debated subject, and the members of this association might well ask that a careful and very plain statement be made covering the point.

REACTANCE IS NECESSARY FOR STEADY OPERATION.

The alternating street lighting system has been before central station people only about two or three years. From the start, it was thoroughly appreciated that the prejudices existing against an alternating arc lamp necessitated that such a system must be absolutely satisfactory in operation to suggest even a partial success. It was the distinct purpose of the engineer to introduce such an amount of reactance in the system as would at all times effect steady and reliable operation. The series coils introduce a lagging current in the lamp which lowers the power factor, but at the same time produces a reliable lamp. The system complete has a sufficient amount of reactance, and the result is a hardy and substantial arc lighting service.

A multiple direct-current lamp improperly adjusted so that an insufficient amount of resistance has been connected

into the circuit, will pound and chatter, and furnish an interrupted service. The trouble, however, is confined to that particular lamp.

A multiple alternating lamp, having the reactive coil improperly adjusted so that there is too much or too little inductance in circuit, will produce poor results, but here also the trouble is confined to the individual lamp.

A series system designed with insufficient reactance will cause the regulator coils to pump; trouble ensues immediately. This trouble not only affects one lamp, but it extends over the entire series. It not only affects the arc lighting, but extends to the incandescent service. The secondary circuit may vary in potential from 95 to 120, and the incandescent service has been made seriously unsatisfactory because of insufficient reactance in the arc lighting system. First-class, reliable service is the first essential. A difference of 10 per cent in power factor demands only a slightly increased investment, while the actual cost of operating is practically the same.

INSULATE THE ARC SERVICE THOROUGHLY.

So much has been said of late years in respect to insulation of multiple transformers that central stations have readily appreciated the necessity of insulating the arc lighting system thoroughly from the main distributing system. Where a reactive coil system is under consideration for street lighting, it is recommended that a constant potential transformer be installed between the generator and the arc lighting regulator. The following sketch clearly illustrates the reason for this recommendation.

MISCELLANEOUS METHODS OF ARC LIGHTING.

Many schemes have been considered in connection with street lighting from the alternating system. Quite frequently the argument is presented that multiple alternating lamps can be used with practically the same degree of economy and convenience which has favored the series alternating system. Where the wires from the old arc systems were strung out from the station in pairs, instead of a loop, there would be a greater tendency to consider an installation of the multiple lamp. The question would naturally arise as to whether they would be installed on those constant potential transformers, which were used for commercial and residence lighting. If so, the lamps would have to be controlled individually, necessitating switching them off and on by an attendant, or collectively, by means of some magnetic switch. The first method would be expensive and lamps could not be lighted simultaneously. The second method would require special additional wiring. At the present writing, street lighting by multiple alternating lamps has simply been considered in isolated cases. The idea does not seem to have special merit.

Another method which has been suggested might be illustrated in connection with a 500-light system. A large constant potential transformer installed at the station is arranged with loops brought out on the secondary side to accommodate ten 50-light circuits; each circuit having a reactive coil installed as a regulator for series alternating lamps. One objection to this arrangement would be that should any accident happen to this transformer, the entire arc lighting system is put out of service. If an attempt is made to avoid this point by using two or three smaller size transformers, the system becomes complicated and the attempt to secure high efficiency, together with low cost, is defeated.

CONSTANT-CURRENT TRANSFORMERS, MONONGAHELA POWER COMPANY.

It is, therefore, a fair statement that the most practical, economical and all-around satisfactory system which has met the actual service among 300 central stations all over the country is the series alternating arc system, operated from constant-current transformers.

WONDERFUL INCREASE IN USE OF ALTERNATING LAMPS IN GENERAL.

During the years of 1895 and 1896, records show that only a few alternating open arc lamps were in use. Not more than 1,000 to 1,500 alternating lamps were introduced by central stations during the year 1896. In 1897 the first satisfactory enclosed alternating lamp was made commercially successful, and in the years 1897 and 1898 between 20,000 and 30,000 lamps were placed in actual service. During 1899, practically 30,000 of these lamps were required to meet the demands of the central stations, while during the year 1900 between 50,000 and 60,000 alternating lamps were installed. As a result, about 125,000 alternating lamps are to-day in actual service. Most of these have been installed during the short period of three years. They have made it possible for stations equipped with alternating generators to establish their commercial arc lighting on a profitable basis, meet competition from Welsbach burners and contract with their respective cities for the street service with a commercial system of alternating street arc lighting.

Estimated conservatively, the additional income of the central station business, since the introduction of alternating arc lamps, has been from $5,000,000 to $8,000,000.

ANNUAL COST OF MAINTAINING ENCLOSED ARC LAMPS.

In the past the attention of your association has been called almost entirely to the estimated annual cost of operating enclosed arcs. The table below shows the actual figures taken from the books of an electric lighting company, and is representative of central station practice. It is of interest to note how closely the figures representing actual practice approximate the estimated figures which have been commonly recognized heretofore.

REPAIRS ON TRANSFORMERS AND LAMPS.

It is a reasonably fair statement to say that the alternating street lighting system in service has shown a high degree of economy in respect to repairs. The illustration on this page represents an arc service of 250-light capacity which has been installed for more than two years, yet the covers on the transformers have never been removed.

Another service of 700-light capacity in use for three years has required no repairs to the transformers. It is easy to appreciate the reason for this when con-

sidering that the mechanical parts are required to move over a short range but twice during a night run, or 730 times per year. As compared with revolving machinery, the advantage is apparent.

Regarding repairs on arc lamps, the beginning of the Twentieth Century finds that development has extended particularly along two distinct lines.

First—A determined effort to offer central stations a rugged and substantial lamp, as simple in construction as skill can devise and the electric science permit.

Second—Reduction of maintenance expense by furnishing a universal, interchangeable type of lamp for interior or outside service, as well as interchangeable, for any class of circuit.

The success which has attended this movement, is shown by a glance at the six interchangeable arc lamps illustrated below.

The interchangeable feature has been successfully carried out in every type of lamp necessary to meet the varied demands of central station business.

Shortly after your president extended to me the courtesy of reading a paper before this association, he received a letter from one of the prominent central station managers of the West, extract from which is given below:

"There is a question regarding which I have been wanting to write to you for some time; a question that it seems to me is of great interest to the central station people as well as to the manufacturers, and that is, the adoption of some standard size outer and inner globes and carbons for enclosed arc lamps.

"It seems to me that every time a new lamp is put on the market, they vary the inner and outer globe so that a special stock must be carried for not only each maker's lamps, but in some cases several different sized globes for lamps made by one manufacturer. It is very annoying, and almost a physical impossibility, to keep a stock of globes on hand to meet the requirements.

"We have insisted in the past on having the inner and outer globes fit any lamp that we buy, and it seems to me that this is a matter that should be taken up by the association and some action taken."

It is a pleasure to be able to report the progress which has been made along this line, and to note how closely the development and actual results have approximated the needs of the central stations, as set forth in the above communication.

Not only have the manufacturers of arc lamps contributed to this advancement, but the glass manufacturers have thoroughly appreciated the benefits of the interchangeable type of globe. In fact, I believe there is an understanding among the prominent glass manufacturers, that they will not only favor any steps in the direction of standardizing globes, but will place a severe penalty upon special styles, shapes and sizes of globes.

On the subject of standardizing carbons, it is the universal custom to use ½ by 12-inch solid carbons, for the following standard direct-current lamps:

First. Multiple type for 110-volt circuits.

Second. Multiple type for 220-volt circuits.

Third. Series type for 220 and 550-volt power circuits.

Fourth. Series type for series arc circuits.

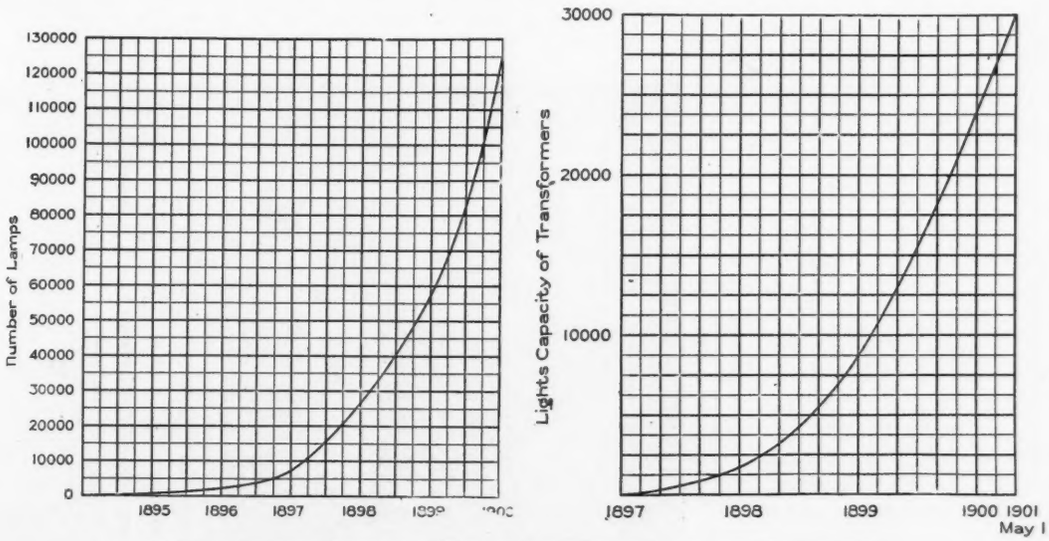
It is equally true that ½ by 9½-inch solid and cored carbons are universally used for the following standard alternating-current lamps:

First. Multiple type for 104-volt circuits.

Second. Series type for series arc circuits.

In all of the standard lamps mentioned, the designer arranged so that the unconsumed portion of the upper carbon could be used in the lower holder, thus eliminating the necessity of carrying any other but 9½ by 12-inch lengths.

Exhaustive experiments to date have not as yet been sufficiently successful to warrant the standardization of solid carbons for alternating lamps. On the contrary, the best practice favors one cored carbon for such lamps. It is a fair question to ask, "Why was the alternating lamp designed to take 9½-inch carbons, as against the standard 12-inch length?" Good



CURVES SHOWING INCREASE IN USE OF ALTERNATING LAMPS AND TRANSFORMERS.

COST OF MAINTAINING ENCLOSED SERIES ALTERNATING-CURRENT STREET ARC LAMPS, HAMPTON, VA., 1900.

	June.	July.	August.	September.	October.	November.
Number of hours burning	240	248	294	307	372	411
Average life of carbons	41.50	61.55	80.07	60.00	70.00	75.00
Number of lamps	69	69	69	63	81	81
Number of solid carbons used	200	145	166	176	215	222
Cost of solid carbons	$4.45	$3.13	$3.70	$3.92	$4.78	$4.94
Number of cored carbons used	199	146	166	177	215	222
Cost of cored carbons	$4.73	$3.47	$3.94	$4.41	$5.11	$5.27
Inner globes used	5	5	7	10	5	8
Cost of inner globes	$0.95	$0.95	$1.05	$1.50	$0.95	$1.20
Outer globes used	6	2	3	1	6	3
Cost of outer globes	$2.70	$0.90	$1.35	$0.45	$2.70	$1.35
Labor trimming, cleaning, etc	$11.70	$11.70	$11.70	$11.70	$13.95	$13.95
Total cost of maintenance	$25.53	$21.15	$21.74	$21.98	$27.49	$26.71
Cost per light	$0.37	$0.306	$0.315	$0.317	$0.338	$0.329

reasons may be given, namely, in a direct-current lamp the positive carbon burns twice as fast as the lower. A 12-inch carbon is therefore necessary. In an alternating lamp the upper carbon is consumed at the same rate as the lower.*

Summarizing: On the subject of standardization, in regard to arc lamp globes, carbons, parts, etc. It would appear as if the results so far accomplished have been heartily cooperative with the suggestion referred to above, representing the demands of the central station managers.

There is probably no subject which has been given greater attention by the manufacturers in the past 12 months, than these features of interchangeability and standardization, and the central station representatives are subject to congratulation that their efforts have been crowned with such a great degree of success at the beginning of the Twentieth Century.

USE OF METERS FOR STREET LIGHTING CIRCUITS.

Having arrived at definite conclusions as to the cost of maintaining arc lamps for both interior and street lighting service, such as carboning, trimming and all items coming within the maintenance account, it becomes necessary to turn to the subject of metering energy and securing accurate cost of the current consumed.

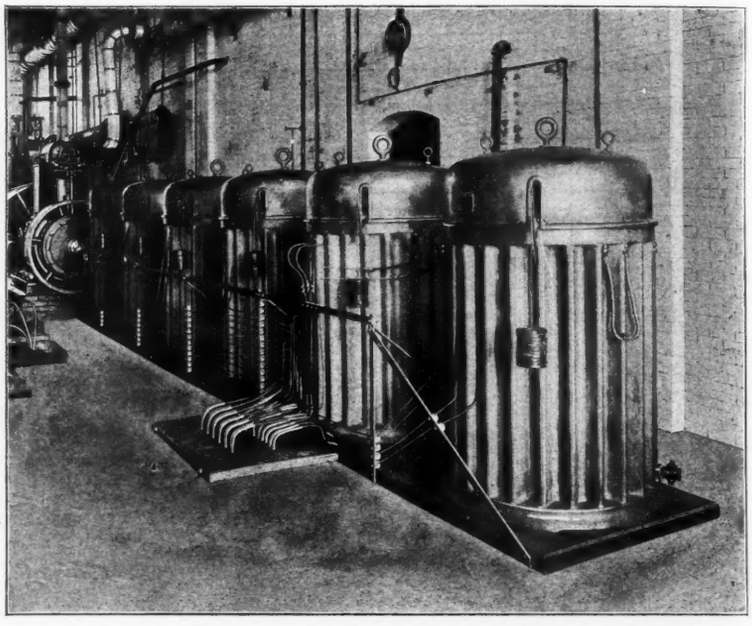
Competition in connection with street lighting, a desire to know the efficiency of the street lighting system and many other reasons contribute to make the adoption of wattmeters for both alternating and direct-current arc street lighting systems a growing necessity. Such meters are now used in considerable quantities; they are a standard article and readily obtainable by central station people. Quoting from brief statements from such an eminent authority as Mr. C. D. Haskins, who attaches great importance to this subject:

"Municipal arguments. It is not unusual for municipalities to claim that lights are not burned the requisite number of hours. The daily meter record of each circuit tells the story. There can be no dispute when the station's arguments are based on kilowatts output per night.

"Municipalities claim that lamps are out. A meter record for the night can be reduced immediately to arc-lamp-hours. This argument resembles the other.

"Municipalities sometimes claim that less energy is delivered to their arc circuits than they are entitled to. The same argument prevails as above.

"For the benefit of the station it is important for the management to know how many kilowatts it is devoting from its total capacity to municipal service. This is the only way to know exactly what municipal service or commercial arc circuits are costing. An excessive meter record on a given service for any given night means something wrong. Without such a record a station might be a week in discovering a trouble. A low record means lamps out. Lamps out are not always reported. The meter tells the story and tells where to look. If the meter record is low, and the inspector's report shows all lamps burning, the meter says look for trouble in the lamp."



CONSTANT-CURRENT TRANSFORMERS FOR 250-LIGHT SERVICE—TEMPORARY WIRING.

In many sections of the country, electric lighting companies have had difficulty in securing cooperation from the city authorities in respect to trimming trees; in fact, it is not infrequent that we meet cases where city authorities have entirely ignored the efforts of the lighting company in attempting to have the trees trimmed so as to favor first-class light distribution. It is, therefore, of great interest to note the remarks of an authority on the subject of tree trimming, Mr. Christopher Clark, forester and member of the Massachusetts State Forestry Association, Northampton, Mass., who has been for 25 years in charge of the city's trees and shrubbery. He writes as follows:

"The rule we have adopted in the cities and towns in the state of Massachusetts is to cut off the branches high enough to see into the roadway from the second-story windows of the houses. This gives a good distribution of light and leaves the trees on the entire street on a good even line, with no low branches to shut out the light.

"It is my experience that trees on city and town streets thrive better and live longer when thus trimmed, especially when stone and asphalt sidewalks and roads take away the moisture that trees in parks and lawns receive. There is no question but this method of trimming is the best for the life and growth of the street trees, and at the same time secures a far better distribution of light that could not be accomplished if the lower branches were left to obstruct the light."

It is needless to mention that if such state organizations exist in other sections of the country and city foresters offer equally hearty cooperation with the lighting companies to secure the best light distribution for street illumination, opportunities will be afforded for effecting a decided improvement in connection with street lighting in general.

Endurance Contest of the Dutch Automobile Club.

At its last meeting the Dutch Automobile Club, of Holland, determined upon holding an endurance contest which is to cover a distance of 330 miles and to be run in four days, the highest average speed permitted being 12½ miles per hour. The vehicles participating will be judged according to the number and length of stops. The contest will be open to all members of the Dutch Automobile Club and of recognized foreign organizations of a similar character. No date has as yet been set for the contest.

*If the upper carbon should be made 12-inch instead of 9½-inch, the waste in using the unconsumed portion for the lower holder would be excessive. If the lower carbon should be lengthened in an attempt to overcome this, the length of entire lamp is changed, opposing interchangeability of lamp parts and standardization.

THE CONSTRUCTION OF SMALL TELEPHONE EXCHANGES—X.

BY A. E. DOBBS.

PRECAUTIONS TO BE OBSERVED IN CONDUIT WORK.

One of the chief troubles to be guarded against, supposing that underground work is decided upon, is electrolysis, which is caused by return currents from street railway tracks, or in some cases, other grounded systems that use a considerable current output. It is a trouble that in an extensive cable system can only be avoided by the most constant vigilance, especially if the conduit closely parallels the street railway line, which is nearly always necessary, owing to the fact that these lines usually pass through the best business portions of the town which the telephone lines must also have access to. Even when the conduit is laid in alleys many feet distant from the tracks, it is difficult to avoid crossing the tracks or other pipes which cross them, which, in some cases, might be even worse than actually paralleling.

If, as explained in a previous chapter, it were possible thoroughly to insulate underground cables, or at least ground them only in such places as might be desired, then the solution would become an easy one; but as this can not be done except at a cost that would be prohibitive we must, for the present at least, do the best we can with a cable grounded to a greater or less extent throughout its entire length. Wood, stone, tile or cement ducts all allow a certain amount of leakage to the earth unless they can be kept perfectly dry, which is not often the case; and when to this is added the fact that branch leads and distribution to terminals are often made through iron pipes laid in the ground, it follows that there are many ways open for compelling the cable armor to carry current that does not belong to it. This subject of electrolysis is pretty well understood, but a brief explanation may not be out of place.

If the street railway tracks were electrically continuous they would carry all the current that passes over them with very little loss, but such is not the case, for bad joints in the track and imperfect connections elsewhere make the track a very uncertain conductor at the best, especially after the track has been in use for some time.

Thus the current from the power-house, not finding the track a good conductor, leaves it and in part travels through the surrounding earth. For, as is well known, where the electric current has a choice of two paths it will pass over both of them in inverse proportion to the resistance encountered in each. If one conductor has a resistance of, let us say, 1,000 ohms, while another has a resistance of only one ohm, the conductor of low resistance would carry 1,000 times more current than the other. If, on the other hand, both paths were of equal resistance then both would carry an equal amount of current.

Now let us apply this rule to street car rails, first taking the resistance of steel at 6,500 pounds per mile ohm (the weight of a steel rod having a resistance of one ohm to the mile). A rail weighing 90 pounds to the yard would therefore weigh 158,400 pounds to the mile, or 316,800 pounds to the mile for the two rails. Dividing this weight by the weight per mile ohm of steel gives us $316,800 \div 6,500 = 49$—which means that a track of this kind has a theoretical resistance of one-forty-ninth of an ohm to the mile and would therefore carry 49 amperes of current with a loss of only one volt for a single track or double this amount for a double track, provided the two are cross-bonded so that there is no potential difference. between them. As a matter of fact, however, the resistance of the track bonds alone will come to considerably more than this, and though they are often reinforced by heavy copper return feeders that are connected to the track at intervals to counteract the effects of bad joints, still we often find a "drop" of 200 or 300 volts at the end of a five-mile line which can not be accounted for by any possible loss in the overhead feeders. The greater the resistance of the track return the greater the escape of current into the surrounding earth, and if there should be any lead cables, water or gas pipes in that vicinity, they, being better conductors than the earth in which they are laid, will carry the greater part of this stray current. Now, as long as this current is coming from the track to the cable, no damage is done, but where, owing to changes in the route of the cable or great differences in the track potential, the current begins to go back to the station, at these points the cable sheath begins to decay. We have an analogy to this in the ordinary primary battery, in which the current passing from the zinc to the copper, or carbon, plate causes the zinc to dissolve; the action on a cable is just the same, the only difference being that lead or iron instead of zinc is dissolved.

FIG. 44.—CURRENTS BETWEEN TRACKS AND BURIED CABLES.

As we can not well prevent stray current from getting on the cable sheath, the next best thing we can do is to make its escape back to the tracks as easy as possible. This can be accomplished by first finding out just where this leakage back to the track or to the surrounding earth takes place and connecting the cable to the track or to other pipes at this point by means of a heavy copper wire. It is not necessary or desirable that the cable should be connected to the track indiscriminately, for in that case we have the cable acting as a return feeder for the road and then we would have the cable responding to all the fluctuations of current in the road which would not only be a bad thing for the telephone service but, by carrying a larger amount of current, the leakage into the surrounding earth would be proportionately greater and our trouble increased instead of diminished. This is illustrated in Fig. 44. Should there be no connections to the track at all, the cable would receive more or less current from the road as indicated by the dotted lines and give it up again when the drop in voltage takes place. It may be that the cable is carrying under ordinary conditions, say, 25 volts of this pressure which may be distributed over a mile of cable, and therefore it does no particular harm.

Should, however, the conduit be damp in some places and dry in others, then the leakage would naturally flow out at those places in the B section, and destructive effects follow. There is still another cause of trouble besides dampness. Suppose that somewhere in the B section there should be placed an iron pipe for the purpose of leading the cable up at a pole or other distributing point; this pipe being placed in the ground naturally affords a good chance for the return current to equalize itself with the track, and it can be safely assumed that considerable, or the larger part, of the current will escape there; or, if the pipe should be placed in the A section, it would result in leading more current to the cable, and therefore make the escaping current in the B section greater in volume. As explained before, an insulated cable would not receive or deliver any current.

An iron pipe outlet constitutes still another danger; should by any chance there be a sudden fluctuation of current in the trolley line, where might be a spark at this outlet—for owing to dirt and other

substances the cable only makes contact with the iron pipe in spots—and as few conduit systems are entirely free from gas this spark might be the cause of a very serious explosion. In at least one case investigated by the writer this is precisely what took place, as the foreign current in that case was great enough to leave its marks on the cable sheath.

Referring to Fig. 44 again, if we were to connect the cable to the track in the A section as shown, and again bond it at the B section, the cable would be helping the track to carry the difference in current represented by 250 and 500 volts, respectively, which might be in this case 100 amperes. Should, however, the bond wire be omitted in the A section and applied in the B section, then the escape indicated by the arrows would be neutralized by the bonding wire. In order to prevent electrolysis, however, it might be necessary to connect the cable to the track at intervals of every mile or even half-mile, till the danger is past which will be when the cable changes its route.

In testing cables for leakage of this kind use a low-reading voltmeter and make tests at every manhole, both to the tracks and to the surrounding pipes, beginning at the outer end of the cable first, where, if more than 10 volts difference of potential is found, connect to the track or other pipes. This may remove most of the stray current from the cable sheath, but if it does not, connect to the track or to other pipes wherever more than five volts difference is found, and in this way most of the trouble from electrolysis can be prevented. These tests should be repeated every few months, as the resistance of the track is constantly changing. There should also be some arrangement with the railway companies to induce them to keep their tracks properly bonded, which they are generally willing to do if properly approached on the subject. If they refuse, then recourse may be had to the city authorities or the courts, but the law in some states is rather hazy on this subject and legal action should be avoided if possible.

If the conduit is of stone, cement, wood or tile, while iron pipe outlets are used, wrap the pipe in tarred burlap to keep it away from direct contact with the earth, or set it in cement, or in a wooden box tarred inside and out. This will prevent heavy grounding at any one spot and distribute the leakage more equally, besides doing a great deal to keep it away from the cables altogether.

Small exchanges are sometimes more liable to trouble of this kind than larger ones, as trolley roads in small towns are more cheaply built and have fewer cars, making, therefore, greater fluctuations of current.

THE INDEPENDENT TELEPHONE CONVENTION.

THE FORTHCOMING MEETING OF THE INDEPENDENT TELEPHONE ASSOCIATION OF THE UNITED STATES OF AMERICA, AT BUFFALO, N. Y.

As already announced, the fifth annual meeting of the Independent Telephone Association of the United States of America will be held in the city of Buffalo, N. Y., on June 11, 12 and 13, 1901. The programme in full is as follows:

Tuesday, A. M.—Reception of delegates, distribution of badges, tickets, etc., at headquarters, Iroquois Hotel.

Tuesday, noon—Opening of the convention in the banquet room of the City Convention Hall, corner Virginia street and Elmwood avenue.
Address of welcome, Hon. Conrad Diehl, Mayor of Buffalo.
Response, by James M. Thomas, of Cleveland, president Independent Telephone Association of the United States.
Annual address by the president of the association, Hon. James M. Thomas.

Tuesday afternoon—Inspection of exhibits made by manufacturers, in connection with headquarters at Iroquois Hotel.

Wednesday, 10 A. M.—Second session of the convention, at Convention Hall.
Paper by Hon. S. P. Sheerin, New Long-Distance Telephone Company, of Indianapolis; subject, "Village Exchanges and Farmers' Lines."
Discussion by J. B. Ware, of People's Telephone Company, Detroit, Mich., and T. J. Fricker, of Ashtabula Telephone Company, Ashtabula, Ohio.
Paper by Chas. E. Wilson, of Keystone Telephone Company, Philadelphia; subject, "Independent Telephone Development East of the Alleghenies."
Discussion by C. E. Stinson, Rochester Telephone Company, Rochester, N. Y., and Senator C. W. Kline, of Hazelton, Pa., president Inter-State Telephone and Telegraph Company of Pennsylvania.
Paper by L. W. Stanton, Cleveland, Ohio; subject, "Exchange Service."
Discussion by convention at large.
Reports from various states, and other business.

Wednesday afternoon—Inspection of exhibits by manufacturers, in connection with headquarters at Iroquois Hotel.
Pan-American Exhibition and Niagara Falls.

Thursday, 10 A. M.—Third session of the convention, at Convention Hall.
Reading of paper by H. D. Critchfield, general counsel Cuyahoga and United States Telephone companies, Cleveland, Ohio; subject, "Legislation and Litigation."
Discussion by Ed. Kibler, of Newark Telephone Company, Newark, Ohio, and C. S. Bash, Home Telephone Company, Fort Wayne, Ind.
Reading of paper by E. B. Fisher, of Citizens' Telephone Company, Grand Rapids, Mich.; subject, "Bell Methods."
Discussion by Geo. W. Beers, of National Telephone and Telegraph Company, Fort Wayne, Ind., and W. A. Bisbee, of Georgia Telephone and Telegraph Company, Savannah, Ga.
Election of officers and unfinished business.

The present officers of the association are James M. Thomas, president, Cleveland, Ohio; H. C. Young, first vice-president, Columbia, Pa.; C. E. Stinson, second vice-president, Rochester, N. Y.; H. E. Teachout, third vice-president, Des Moines, Iowa; S. P. Sheerin, secretary and treasurer, Indianapolis, Ind.; R. F. Johnson, first assistant secretary, Saginaw, Mich.; Sam. E. Wayland, second assistant secretary, Scranton, Pa.

The following gentlemen form the membership of the advisory board: James M. Thomas, Cleveland, Ohio; S. P. Sheerin, Indianapolis, Ind.; Hugh Doherty, Bluffton, Ind.; E. B. Fisher, Grand Rapids, Mich.; W. H. Durin, Cedar Rapids, Iowa; W. B. Seaton, Ashland, Ky.; Geo. W. Beers, New York, N. Y.; H. D. Critchfield, Mt. Vernon, Ohio; Sam. E. Wayland, Scranton, Pa.

At a recent meeting of the advisory board of the association, held in Chicago, the following resolution was unanimously adopted:

Resolved, That no company will be entitled to admission to the coming annual convention of the Independent Telephone Association of the United States, at Buffalo, and to participation in its proceedings, reports, advantages, etc., save those who shall have paid at or before the opening session, on the eleventh of June, their annual membership fees for the association year of 1901-02, which said fees shall be at the rate of two cents per telephone for each telephone station represented, and two cents per mile for each pole-mile of toll lines represented.

As can be seen from an inspection of the programme above, the subjects for discussion at this convention are of much importance. The subject "Village Exchanges and Farmers' Lines" is one that has not met with the recognition to which it is justly entitled. Every step that is made to extend further the field of telephone service is of great benefit to the industry at large, to the general public and, incidently, to all connected in any way with telephony. The telephone line which once feels its way across country never comes down, and in time grows to be perhaps an

important connecting link in the web of communication lines that is rapidly spreading over the country.

The important subject of "Independent Telephone Development East of the Allegheny Mountains" will come in for its just share of attention. So far, the great bulk of independent telephone work has been done in the middle regions of the United States, and in the district between the Allegheny Mountains and the Mississippi River. For many reasons the establishment of independent systems in the seaboard cities is more difficult, but it is hoped that the discussion will bring out new light on this important matter.

The very important subject of "Legislation and Litigation," in the various aspects of these as applied to the work of telephone companies, will be ably discussed, the names of the members selected for this purpose being a sufficient guarantee of the value of the discussion that will ensue. The wise provision of nominating members to take up the discussion of certain subjects with which they are familiar will insure interesting meetings, limit the time devoted to discussions and at the same time produce matter that can not fail to be of significance and importance.

Like other conventions meeting in Buffalo and its vicinity this summer, the Independent Telephone Association will enjoy the advantages of the Pan-American Exposition and that perennial watering-place, Niagara Falls. The telephone exhibits at the Pan-American Exposition are practically completed, and are among the most notable of the displays in the electrical section.

From indications already received, and especially on account of the pressure for engagement of hotel accommodations in Buffalo, it is believed that this convention will be the largest in the history of the association.

A Glimpse of an Electrical Fairyland—Decorative Lighting Effects at the Pan-American Exposition, which Will Be a Feature of the Show During the Sessions of the Telephone Convention, June 11, 12 and 13.

Proposed Telephone Improvements in Vienna.

A plan is now being considered by the Austrian Ministry of Commerce by which every house in Vienna may have a small telephone central and interior communication, the central being connected with the outside local and long-distance wires. As Vienna is built on the flat system and there are rarely less than 20 families to a house, the house central will be in charge of the porter and the cost for each telephone in the apartments will be only $12 per year.

Jacksonville Telephone Company Rebuilding.

In the recent fire which practically wiped out the city of Jacksonville, Fla., the Jacksonville Telephone Company suffered a heavy loss. Its central office, switchboard, wires, cables and telephones were completely destroyed and the estimate of Mr. W. M. Shine, president and general manager of the company, is that 400 telephones were destroyed and that the general loss foots up about $30,000. While the wreckage is being cleared away new cables, poles and equipment have been ordered by telegraph and a switchboard selected. Temporary quarters for the company have been selected and it is expected that regular business will be begun within a few months, when the rebuilding of the plant will be completed.

New Power-House in Williamsport.

If present plans are carried out an electric power plant will be built in Williamsport, Pa., at a cost of $150,000 to furnish power for electric traction and lighting. Plans for the new building are now being drawn and it is believed that the plant will be a model in all respects. The three-wire system will be used.

MODERN TELEPHONE ENGINEERING—VI.

(Concluded.)

BY KEMPSTER B. MILLER.

In Fig. 25 is shown a distributing board which is happily a relic of the past, but which, in its day, was distinctly superior to others and may be said to have served its purpose well. This picture was taken from the inside of the distributing board which was in the form of a hollow square, one corner of which is shown. This accommodated about 4,000 lines entering the old Bell exchange at the corner of Fourth and Pine streets, in St. Louis. The line wires were practically all aerial and were brought to a large tower at the top of the exchange building; they were then led down in suitable cables, as shown in this picture, which cables were fanned out for attachment to the clips on the upper portion of the distributing board. In the same manner the switchboard cables were led up to the lower set of clips on the distributing board. Connection between any line wire and any switchboard wire was then completed by means of the jumper wires, as readily seen.

It is the object of modern distributing boards to do away with the confusion in these jumper wires and to lead them as far as possible in parallel directions in their courses from the line to the switchboard sides of the frames. My next view (Fig. 26) shows the switchboard side of the distributing board of the present main exchange of St. Louis, which exchange takes the place of the old exchange, the distributing board of which was just shown.

FIG. 25.—OLD ST. LOUIS DISTRIBUTING BOARD.

The switchboard cables may be seen leading up from beneath. They are fanned out to the lightning arrester terminals shown on the right-hand portion of the board, these terminals being omitted from the left-hand portion, which latter portion is reserved for future growth. These arresters contain a device which will open the line and ground it if an extraneous current of sufficient intensity to be considered dangerous comes in over the line. Such currents are termed sneak currents, and would do great damage but for these little protectors. The protectors also include static arresters, by means of which a high-potential current is caused to jump to ground rather than go on through the intricacies of the switchboard. The jumper wires are led from the terminals on this side of the distributing board through iron rings, some of which may be seen at the extreme left of the picture and to the line side of the distributing board, a view of which (Fig. 27) is now shown. The terminals on this side are arranged in horizontal rows, and the jumper wires coming from the line side, after passing through their respective rings, are led up or down, as the case may be, to the particular horizontal row on which the desired terminal exists, and are then led along the corresponding horizontal row on which the desired terminal exists, and are then led along the corresponding horizontal shelf to the proper terminal. The cables leading in from the street are permanently connected to these horizontal rows of terminals and may be seen coming in at the bottom portion of the board through the trap door in the floor.

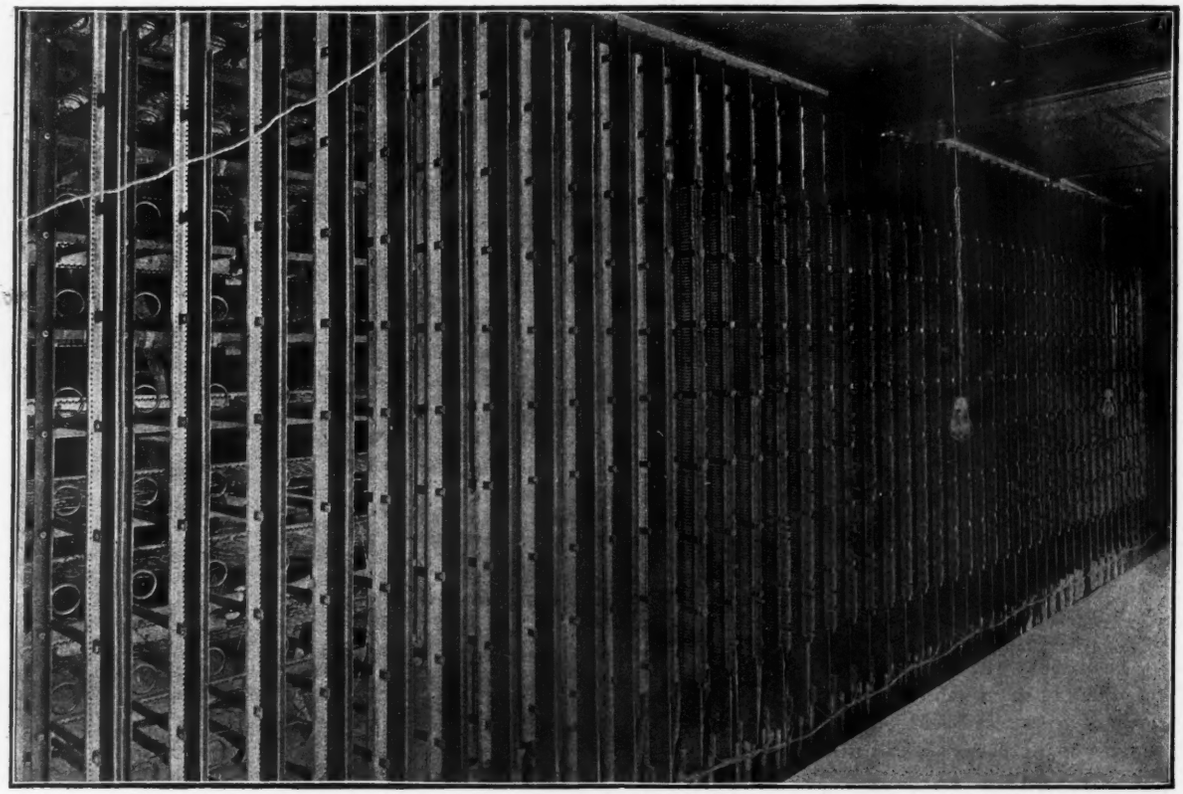


FIG. 26.—THE NEW DISTRIBUTING BOARD AT THE ST. LOUIS EXCHANGE, I.

The next view (Fig. 28) shows a Kellogg distributing board, this particular one being that at the Pittsburgh exchange already referred to. The peculiar feature of this board is that the line and switchboard terminals, instead of being arranged on opposite sides of the framework, as on the board just described, are arranged on alternate vertical strips, there being a strip of switchboard terminals and then a strip of line terminals, and so on. The arresters in this case are put on the cable heads, which may be seen in the rear of the view. Jumper wires are led up or down from the respective line terminals through the large iron rings seen at the bottom and top of the board, and then horizontally to the proper strip of line terminals, and then up or down to the proper terminal on this. The cables from the cable heads in the rear are led up to the line strips from beneath, as clearly shown, while the cables leading to the switchboard may be seen in the iron running frame at the bottom of the picture. I have had a few slides prepared representing in detail parts of the apparatus used in some of the latest Kellogg exchanges. I show here (Fig. 29) a subscriber's automatic switch-hook with the receiver upon it. The next picture (Fig. 30) shows the same hook with the receiver removed. It will be seen that the long lever serves to bend the central spring into engagement with the lower or upper set of springs according to whether the tele-

FIG. 27.—THE NEW DISTRIBUTING BOARD AT THE ST. LOUIS EXCHANGE, II.

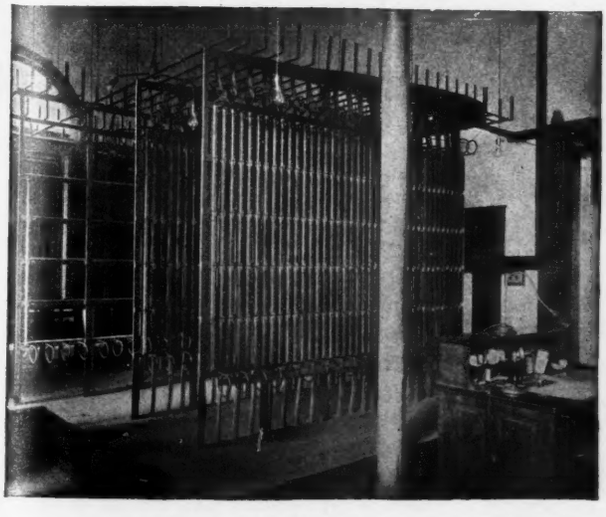


FIG. 28.—KELLOGG DISTRIBUTING BOARD.

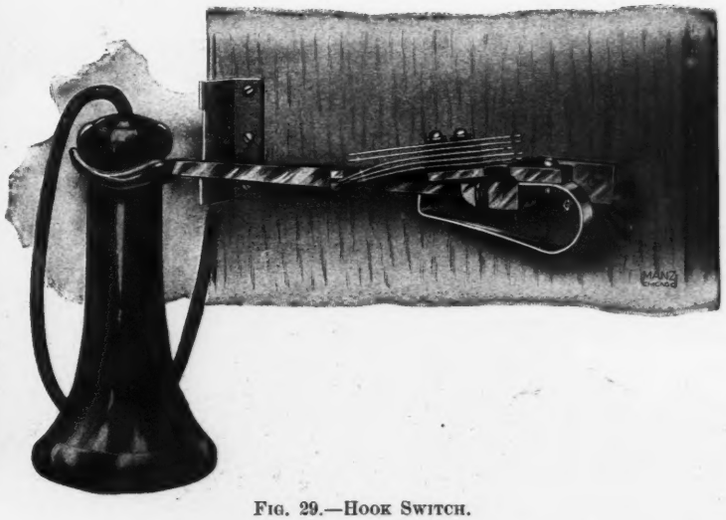


FIG. 29.—HOOK SWITCH.

phone is in use or not. This accomplishes the changes of circuit by which the operator is automatically called and by which she is later given the signal to disconnect, which changes are made, of course, entirely without the volition or knowledge of the subscriber.

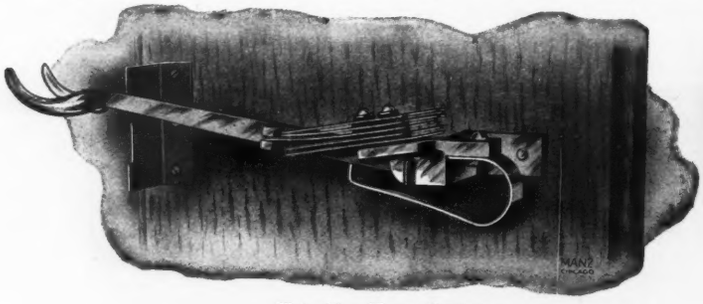


FIG. 30.—HOOK SWITCH.

Passing on to the central office, I will show (Fig. 31) a strip of line relays similar to the ones used in the Pittsburgh exchange. These relays are mounted 20 per strip, as shown.

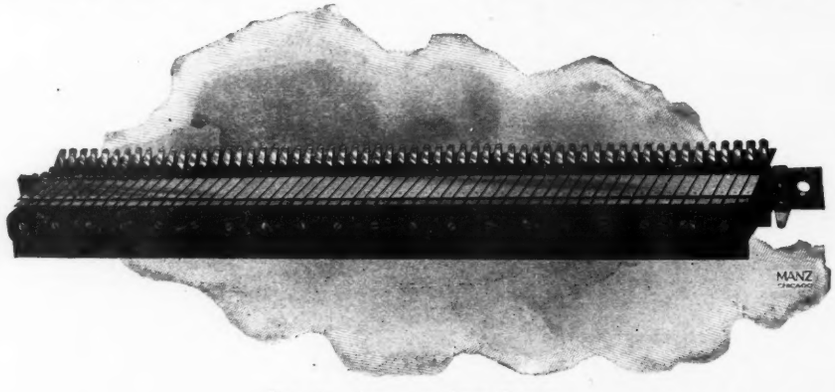


FIG. 31.—STRIP OF LINE RELAYS.

The next cut (Fig. 32) shows a single line cut-off relay. The magnet of this is enclosed in an iron shell which forms a portion of the magnetic circuit. The armature of this relay, when attracted, causes the two long springs to break contact with the lower springs, and to make contact with the two upper springs. I may say, in passing, that all contacts in the best relays of this description are made of platinum. These relays are about one and one-quarter inches in diameter, and the shells are of soft iron about one-eighth inch thick.

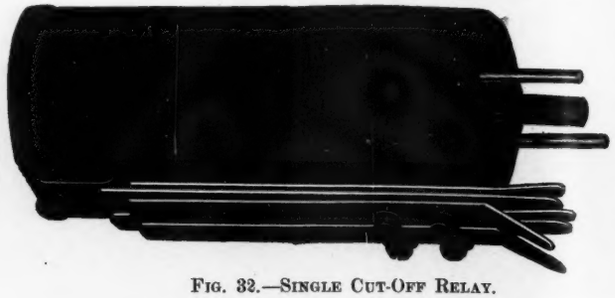


FIG. 32.—SINGLE CUT-OFF RELAY.

In the latest Kellogg exchanges the line and cut-off relays are mounted side by side on the same strip. The view (Fig. 33) shows such a strip containing 20 of each relays, the line relays being the smaller of the two. This strip represents a unit of 20 lines, which unit is carried throughout the entire scheme of wiring in the central office. The next illustration (Fig. 34) shows the opposite side of this relay strip, showing the connecting wires from the various terminals. These terminals pass through walls in the iron mounting strip and are readily accessible for soldering in the wires. In mounting the line and the cut-off relay in such close proximity, many of the wires which would otherwise have to be formed up in cables are reduced to the short, stiff bare wires clearly shown in this picture.

Coming now to the line signals themselves, in Fig. 35, I show a strip of drops, these being mounted on one-half inch centres so as to correspond to the spacing of the jacks. These were used before the adoption of the line lamp signals by the Kellogg company, a strip of which signals is shown in Fig. 36.

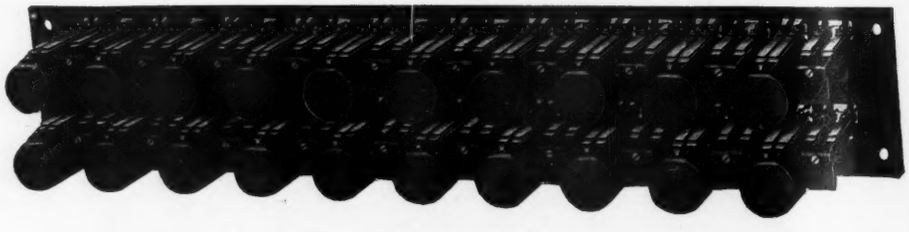


FIG. 33.—STRIP OF LINE AND CUT-OFF RELAYS, BACK.

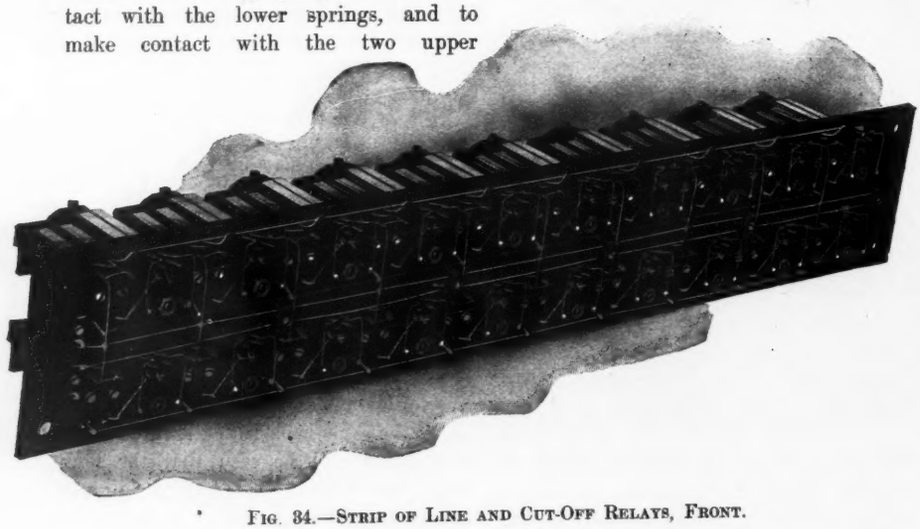


FIG. 34.—STRIP OF LINE AND CUT-OFF RELAYS, FRONT.

This strip is formed from a single piece of hard rubber about 10 inches long and one-half inch thick. The lamps, one of which is shown in the front of the view, are so arranged as to slide into their sockets between the jack springs in such manner as to make the proper circuit connections. In front of each lamp is a little lens, usually of opalescent glass, this lens being carried in a spun brass cap. The advantages of the line lamp signal over the old form of mechanical signals are obvious, the principal ones being the

absolute freedom from complexity, cheapness, and the fact that they may be removed instantly if found defective and replaced by good ones. A defective line lamp may be taken out and another one substituted in less than one-half minute. Another beauty of the line lamp is that when it is out of order it may be thrown away, which is much easier than repairing a mechanical drop. These lamps usually operate at 20 or 24 volts, take about one-quarter ampere and give approximately one-third candle-power. The calculated life of these lamps, with their present degree of perfection and with the average rate of use, is about 30 years, but, of course, this figure remains to be verified by actual service, for unfortunately the telephone business is not yet old enough to prove the statement.

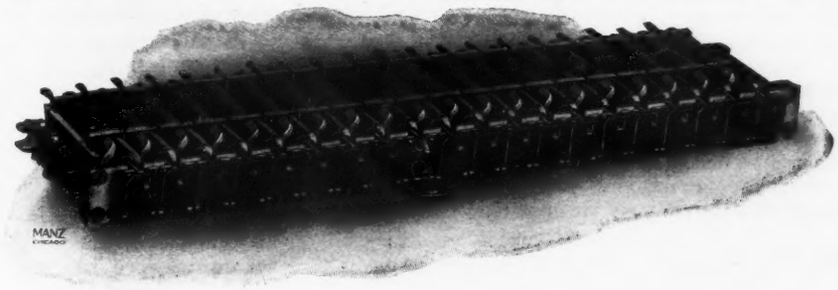


FIG. 35.—STRIP OF DROPS.

I now show (Fig. 37) what is by all odds the most important piece of apparatus in a telephone exchange—the spring jack. This is a strip of the two-point jack already referred to, and it will be seen that they are mounted 20 to a strip on spaces corresponding to those of the lamp jack. The same jack is used for both answering and multiple. This strip is built up of hard rubber, brass and German silver, the front being a solid piece of hard rubber, slightly over 10 inches long, and drilled for receiving the sleeve contacts. The rear of the strip is a piece of hard rubber milled to receive the line springs and the rearwardly projecting lugs from the sleeve contacts. This rear strip is reinforced by a heavy brass strip, into which the screws holding the line springs are threaded. In this particular strip the jacks are on one-half-inch centres, the strip being seven-sixteenths inch high. The spacing with this same construction is readily reduced to three-eighths inch. Where a smaller spacing than this is required, as in a board of extreme size, a somewhat different construction would be used.

I have spoken throughout the evening of cords and plugs, with the details of which some present may not be familiar. The next picture (Fig. 38) shows one of each, the plug being cut away to expose the method of attaching the cord, the cord having its various layers removed to better show its construction. This plug has two contact points instead of three, as described in connection with Western Electric or Bell system. It will be noticed that the two strands of the cord are composed of twisted tinsel, over which a wrapping of floss silk and a braid of cotton are placed. Thus insulated, the two conductors are bound together by a wrapping of cotton, after which they are enclosed in a spiral of brass wire for protection. Over the spiral of wire are placed two layers of linen braiding throughout the entire length of the cord, and for about 10 inches back of the plug a third reinforcing layer is put on. These cords vary in length, according to the size of the multiple board, this length being anywhere

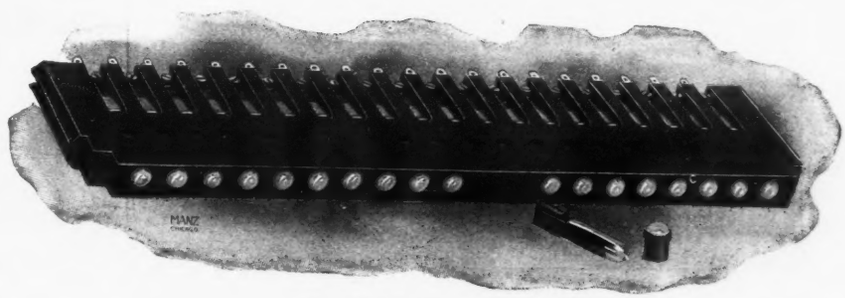


FIG. 36.—STRIP OF LAMPS.

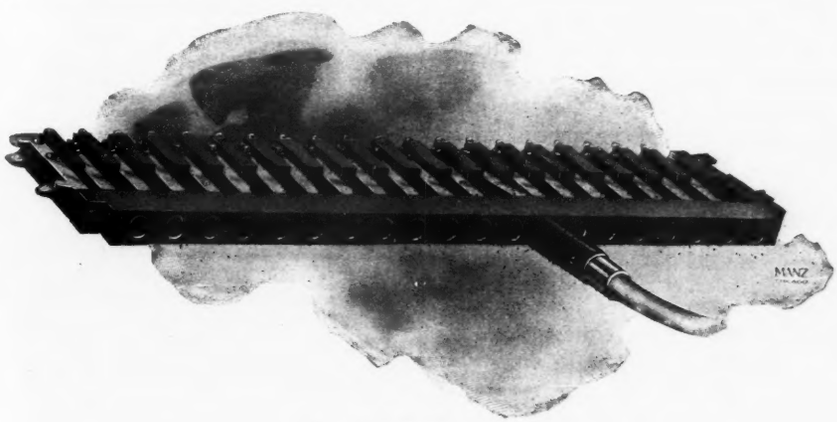


FIG. 37.—STRIP OF JACKS.

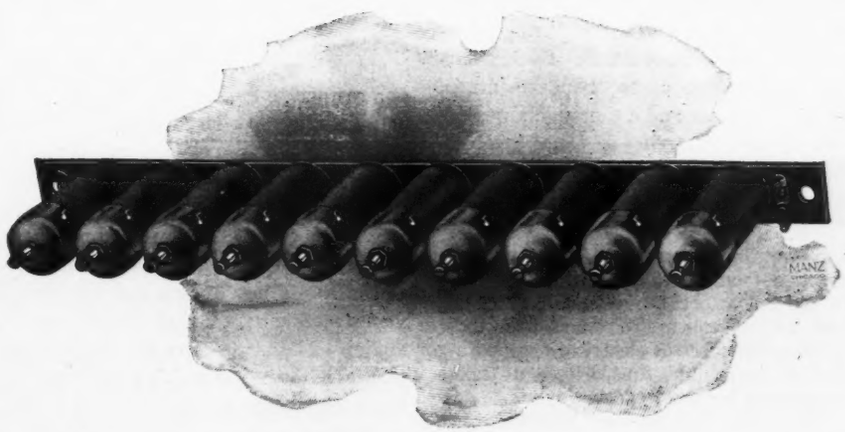


FIG. 39.—STRIP OF SUPERVISORY RELAYS.

from 36 inches up to nearly 100 inches. The next view (Fig. 39) shows a strip of 10 supervisory relays, these relays being the ones used in connection with the cord circuit for controlling the supervisory lamps. These are ironclad, being made in the same shell as is used for the cut-off relay. The armature, a disk of iron about one and one-quarter inches in diameter, is suspended in front of the poles of the electromagnet by a thin leaf spring. The working parts of the relay, including the armature and contact points, are enclosed in a brass cap, which cap locks on the shell with a bayonet joint.

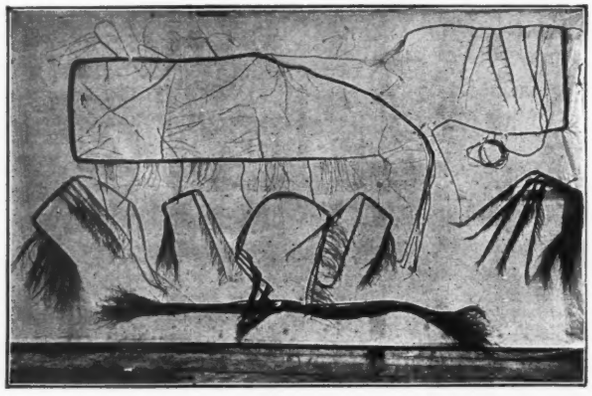


Fig. 40.—Cables "Fanned Out."

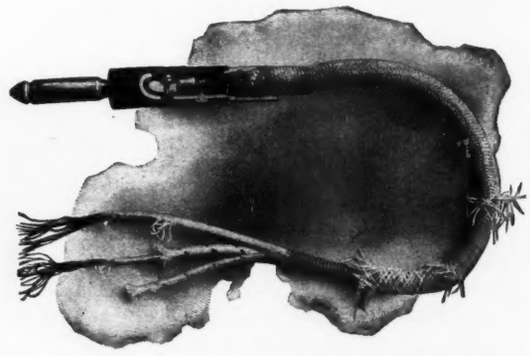


Fig. 38.—Cord and Plug in Section.

The next and last view (Fig. 40) shows a few of the cables used in switchboard work, as they are formed up in the factory. Some of these are made from standard 21 and 41-pair cables in long lengths, with their ends formed and laced to fit the particular portion of the switchboard for which they are required. Some of the other cables are formed up by hand, exactly as shown, directly from the insulated wire, which is usually twisted in pairs. These cables, as you will see, remind one more of diagrams of nervous systems, sometimes seen in medical books, than anything else I can think of.

The design of telephone switchboards and apparatus is a matter requiring attention to almost infinite detail. Besides having a knowledge of the requirements of telephone service and a thorough appreciation of the engineering problems involved, the designer must have a peculiar faculty, which has been termed "telephone sense." Ability to distinguish between apparatus and circuits that will work successfully in practice from those that will work only in the laboratory is not acquired by all; and the problems are so remote from those of other branches of electrical engineering that it is seldom that precedent taken from other branches can be found.

Those who have the best interest of the telephone business at heart are now designing their apparatus and circuits on the basis that telephone systems in small villages must have as good transmission as those in the largest cities, with the idea in view that in the future the whole continent will be one vast telephone exchange, the various large cities being the main offices, the long-distance lines the trunk lines between them, and the small villages the branch exchanges.

I regret that time, together with a lack of definite information, prevents me from treating of Dr. Pupin's recent invention, but this subject is one of such apparent importance that to devote less than a whole evening to it would be to do both the inventor and the audience an injustice.

Anticipating Inventions.

To the Editor of the Electrical Review:

Applicants for patents are usually so discouraged by the rejection of claims on a prior patent that they drop the case, unless arguments and amendments are of advantage. Sometimes, however, the earlier patent is for substantially the same invention, in which case an expedient may be adopted which is too often overlooked. I thought it would be well to call the attention of manufacturers, inventors, and patent solicitors to the expedient of buying up patents that stand in their way. The earlier patentee may have been unsuccessful in introducing his invention into practice, not because of any demerit of the device, but because he has not had the proper facilities, and as a consequence he is apt to be willing to dispose of his rights at a reasonable figure. On one occasion of note in my experience, the patent upon which claims were rejected was owned by a company which had not paid its state taxes for two years. That patent, therefore, cost only $1,300, including taxes. In another instance a company wanted to pigeon-hole a new system and the United States patents were sold at $15,000 and the foreign at $15,000—a small sum in comparison with the loss which would have followed by a new competitor in the field. In another case a manufacturer owned a patent, but by manufacturing he would infringe a second patent. He knew that he infringed, and therefore willingly paid $3,000 for the patent. There are cases where the patents infringed have been bought at a few hundred dollars instead of a few thousand. It all depends upon the lowest figure the earlier patentee is willing to accept. In conclusion, let the applicant for a patent, as a last resort, appoint his solicitor to obtain an offer from the patentee whose patent is cited by the Patent Office as an anticipation of claims. Should the applicant be a manufacturer or associated with capital, and able to afford an investment, he may conclude that he is fortunate if the patent is not yet introduced and is not heaping up piles of money to the inventor.

Edward P. Thompson.

New York, June 3.

The Automobile Club of America.

To the Editor of the Electrical Review:

Referring to the proposed test of the Automobile Club of America from New York to Buffalo, next fall, there seems to be some misunderstanding on the part of the press as to the facts in relation to the Technical Committee of the automobile club, in relation to this matter. The Technical Committee prepared all the general rules and regulations for this test and turned them over to the Board of Governors, who have approved them. The committee then decided, as five out of the eight members of the committee were manufacturers and would practically have entries in the test, that in order to avoid criticism it would be wiser to request the club to put the actual charge of running the test under the supervision of a special committee, free from any manufacturers' interest, in order to avoid criticism on the part of any manufacturer who was, or was not, represented on the committee. In compliance with the request of the Technical Committee, made at the suggestion of the Technical Committee, and at the special request of the chairman thereof, the Board of Governors have appointed a committee of three to take charge of it, who are entirely disinterested from any manufacturers' interest. This committee is composed of Messrs. W. M. Power, W. E. Scarritt and Harlan W. Whipple.

C. J. Field,
Chairman Technical and Contest Committee.

New York, May 27.

News from Great Britain.

(From Our Special Correspondent.)

THE DECISION of the Board of Trade as to the revision of the electric lighting regulation which had previously enabled a recalcitrant consumer to refuse consent to a change in his voltage except upon his own terms (see the ELECTRICAL REVIEW for April 13), practically gives the supply companies and others supporting them all that was asked for. The new rule still provides that no change in the standard voltage—*i. e.*, the voltage at which supply was first given—shall be made without the acquiescence of the customer, but the privilege the "undertakers" get which was not so formerly is a right to appeal to the Board of Trade in the event of an unreasonable refusal, and if the Board itself is unable to settle the point a single arbitrator may be appointed who, deliberating under the Arbitration Act, shall give a final decision. The alteration in this particular regulation involves a slight modification of the previous one, but as the matter now stands another "official obstruction" to electrical progress has disappeared. A sad event in connection with this inquiry is the sudden death, a couple of days ago, of Sir Courtenay Boyle, under whose superintendence the problem has been solved. Another instance in which the public has been done a good service by the much abused Board of Trade, is in a reduction of the maximum tariff allowed in electric lighting provisional orders. Hitherto, any provisional order has enabled the holders of it to charge up to eightpence per unit for current, but this is now to be reduced to sixpence, a price which is more than sufficient in a large majority of undertakings.

The chief feature of the annual exhibition of the Automobile Club of Great Britain and Ireland, which was held from May 4 to 11, was the increased number of home-made vehicles. As usual, electrically driven cars were in a rather striking minority, but less so than previously. It is remarkable what a void there is in the market over here in the matter of electrical motor cars, and although, thanks to one or two pushing agencies, we have some of American make, the fingers on one hand are about enough to record the British manufacturers. Nevertheless, every year shows an important advance, at any rate, as regards quality, on its predecessors and we must feel satisfied that this is so. As to the motor trade generally, the unanimous verdict was that the present exhibition was the finest collection of motor vehicles ever brought together in Great Britain, and the great and increasing demand for this means of locomotion was exemplified by the superabundance of Continental and American firms who exhibited. Nobody is working harder for the good of the cause than the automobile club mentioned above and its latest move is to invite some 400 or 500 councillors from all over the Kingdom to a gigantic demonstration of cars of all descriptions, in order to illustrate to them that mechanical locomotion is not the terrible monster some of the rural governing bodies seem to imagine. The fact that all the cars taking part in the demonstration will be lent free of charge shows a commendable *esprit de corps.*

Such proportions are the proposals to build underground electric railways in and about London now reaching, that it has been found necessary to appoint a Parliamentary Committee to consider these various schemes. The primary function of this committee is to hear evidence bearing upon the question as to whether the proposed routes are best calculated to meet the demands of present and future traffic. Of course, this body and Lord Rayleigh's committee, which was appointed some time ago (see the ELECTRICAL REVIEW for April 13) to inquire into the vibration trouble, will work hand in hand, and nothing will be done in the matter of vibration and compensation until the latter committee's report is submitted. A somewhat reliable forecast of the likely nature of this is afforded by a memorandum which has been handed in to the first-named committee, in which it is stated that Lord Rayleigh's committee is of the opinion that vibration was experienced in a number of instances. Their experiments have shown this to be due to the fact that a large proportion of the weight of the Central London Railway locomotives is not borne on springs and, further, that the rails are not sufficiently rigid. The Central London Railway Company itself has ordered a new type of locomotive from America, and upon the results of these trials the committee's recommendations as to what shall be done in this particular case and also what features shall be introduced in new lines will, to a large extent, depend. For the present session alone no less than eight bills have been deposited for absolutely new underground lines in and near London, besides a few seeking extension of present lines, and, with several others at present under construction, it has at last been realized that electric traction is to play an important part in London's future locomotion.

Now that the 1900-1901 session of the Institution of Electrical Engineers has terminated, the council and members alike may look with pleasure upon the results of the local centre innovation which was started last November. Up to the present there are local sections of the Institution in Glasgow, Dublin, Manchester, Birmingham and Newcastle-on-Tyne. The idea of holding meetings of the members of the Institution residing in these towns and the appointment of committees to manage them has brought forth numerous valuable papers and discussions which otherwise we should not have had the benefit of. For one thing, the authors would probably not have come all the way to London to read them, and, further, the list of submitted papers for the London meetings is so large that there would not have been sufficient time to read them all. It goes without saying that these sectional meetings keep the members in the provinces in close touch with one another, and the system can not be extended too largely in suitable districts. For a first and trial session the results are highly pleasing. The increasing importance and influence of our Institution are further emphasized, inasmuch as there are now local centres at Cape Town, South Africa, and Calcutta, India.

The bill for the extra high-speed monorail line between Liverpool and Manchester, mentioned in my notes on May 11, has succeeded in forcing its way through one of the most critical stages of Parliamentary procedure; *viz.*, a House of Lords committee, and the rest of Mr. Behr's work should be an easy task.

"The first international exhibition of the Twentieth Century" (international without one of the largest countries in the world, *i. e.*, the United States) was duly and fittingly opened to the public on May 2. "In the name of the King I have the honor to declare the Glasgow International Exhibition open and to express His Majesty's best wishes for its success." These were the words by which the Duke of Fife performed the deed on a day when Glasgow had given itself up to holiday making.

The electrical features are, of course, numerous, to say the least. Before saying a few words about these, however, I would like to mention that, in opposition to the Glasgow Corporation service, the National Telephone Company is offering exhibitors a telephone service for one penny per call, for which they can be put into communication with any of the company's Glasgow subscribers. Connection with the trunk lines is also made on payment of the ordinary fees. A large exchange has been equipped in the buildings by the National company, and, altogether, exhibitors will have no more difficulty in transacting their business here than if they were at their own offices.

All English electrical firms of note are represented in one section or another and there is very little difference in the nature of the goods shown to those exhibited by the same firms at Paris. One exhibit of more than ordinary interest was that of the Carver Looms, Limited; *viz.,* electrically controlled looms weaving figured fabrics without the use of cards, the reproduction of the figure being effected from a single metallic sheet bearing the design. Printing by electricity without ink was also exhibited, but, so far, the trade has failed to appreciate this method. Although neither the United States nor Germany has a special section, a good display of goods from both countries is made at the stands of various agents in the English section, and both are probably as well served here as elsewhere. One of the prettiest night attractions is an illuminated water-weir, erected, curiously enough, by Messrs. J. & J. Weir, of Scotland. In a superficial notice of this sort, none of the other sections calls for much comment, as very little of a startling new character is on view. The exhibition, as such, is a model of perfection, and every one within reach of it who does not pay it a visit will miss probably one of the most instructive sights of the Twentieth Century. A. W.

London, May 22.

No Licenses Required for Electromobiles.

By a decision of Corporation Counsel Whalen, of New York, it has been decided that owners or operators of electromobiles in New York city, excepting only those used for public hacks, trucks or other vehicles for hire, need not obtain licenses. The decision was rendered in answer to a letter which Mr. Whalen received from the police commissioner asking for a definite opinion, so that the controversy which has existed for some time between the police and the *chauffeurs* should be ended.

International Association of Municipal Electricians.

At a meeting of the executive committee of the International Association of Municipal Electricians, held in Philadelphia June 1, the following programme of papers to be read at the sixth annual convention of the association, which will be held at Niagara Falls, N. Y., on September 2, 3 and 4, was selected:

"The Need and Value of a Set of Rules for Outside Construction." P. H. Trout, Jr., Lynchburg, Va.

"Underground Electrical Construction from a Municipal Standpoint." Edward F. Schurig, Omaha, Neb.

"The Protection of Fire and Police Telegraph Wires from High-Tension Currents and Lightning." W. M. Petty, Rutherford, N. J.

"Improved Storage Battery for Municipal Purposes." J. W. Aydon, Wilmington, Del.

A paper will also be read by a well-known electrical engineer, dealing with the advisability of placing high and low-potential conductors in the same conduits and manholes.

The committee consists of Morris W. Mead, president, of Pittsburgh, Pa.; John W. Aydon, Wilmington, Del.; Adam Bosch, Newark, N. J.; Frank P. Foster, Corning, N. Y., and Frank C. Mason, of Brooklyn, N. Y.

After adjournment the committee called on Chief Walker, of the electrical bureau of Philadelphia, and secured from him a partial promise to appear at the coming meeting of the association and give the members a talk on "The Lights and Shadows of Municipal Experiences from a Municipal Standpoint."

The Municipal Electricians now have representatives in 110 American and Canadian cities, and are in a growing and flourishing condition. Special arrangements have been made by all the leading railroads for special rates which will permit the members of the association, their families and friends to attend the association meeting at Niagara Falls, N. Y., September 2, 3 and 4, and at the same time visit the Pan-American Exposition. Special arrangements for their entertainment have been made by Mayor Butler and Chairman Donohue, of the executive committee of the association.

Wireless Telegraphy on the Great Lakes.

The officers of the Pere Marquette Transportation Company are planning to furnish all the vessels of that line (seven in number) with Marconi wireless telegraph instruments to enable communication to be made with the vessels while on the lakes. The company had intended to adopt homing pigeons but it was afterward determined to use wireless telegraphy.

Shad and Salmon Slaughtered by Electrical Men.

An annual shad dinner to his friends has become one of the regular kindly events given by Mr. C. E. Trump, of Philadelphia. Mr. Trump's friends arrived at Philadelphia Tuesday of last week and among them were Mr. W. C. Woodward, of Providence; Mr. E. B. Baker, of New Haven, and Messrs. Charles Cuttriss, W. L. Candee, H. Durant Cheever and George T. Manson, of New York. Others joined the party at Washington Park, where the shad were expected, and, after witnessing the hauling in of a three-mile net, discussed a planked shad dinner never equaled as to sweetness of fish in the knowledge of a single guest present. There were other things, too. Senator W. H. Thompson, the owner of Washington Park and many of the electrical interests of that part of New Jersey, including the electric railway to Camden, presented to the lucky guesser of the exact date of a coin a magnificent 10-pound salmon caught at 1 P. M. that day in the net, and the seventh ever caught at that point. Mr. Cuttriss, whose duties as chief electrician of the Commercial Cable Company made him an adept at guessing unknown dates and words, captured the rare fish. How he got it to New York that night and how all the electric car and parlor car passengers became acquainted with the presence of a fish of uncertain age in his possession in a large paper package is quite another story, but one that added gray hair to the head of the man carrying the "dead" fish. It was iced and cooked by Mouquin's, the famous French restauranter of Fulton street, New York, and enjoyed the next day by the New York party. Mr. Trump and Senator Thompson were toasted, as was the cable expert, who, with conductors and passengers arrayed against him all the way from Gloucester to New York, had, notwithstanding, carried that fish to the finish.

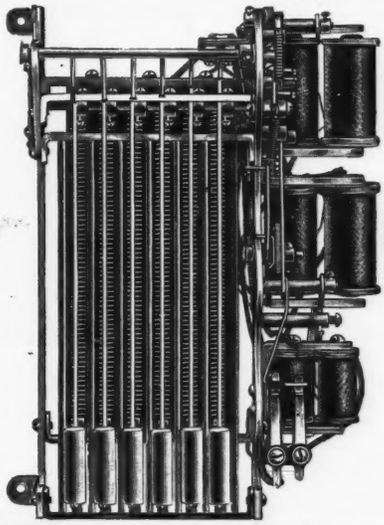
An Electric Railway between Cincinnati and Toledo.

Capitalists of Cleveland, Ohio, have recently secured from the state legislature the right to lay tracks along the banks of the Miami Canal between Cincinnati and Toledo, a distance of 250 miles, for the propulsion of canal boats by electric motors. The charter gives the incorporators of the road the right to place their tracks on the canal bank and retain them for 100 years without any cost, the plan being nothing less than a complete electric line between the two cities with a full equipment for passenger and freight service. The company is soon to be incorporated and will have a capital stock of $2,000,000. Among those interested in the project are the Everett-Moore Syndicate, M. J. Mandelbaum & Company and Mr. William H. Lamprecht.

Some New Telephone Apparatus.

Descriptions and Illustrations of Representative American Telephone Systems, Appliances and Novelties.

ON THIS and following pages will be found brief descriptions, with illustrations, of some representative telephone apparatus. While each new year up to now has resulted in the bringing out of new systems and apparatus, the tendency for standardization is becoming more and more apparent and striking; and it is believed that now American telephone appliances have reached that high degree of perfection when types of an inferior character will gradually disappear, leaving the product practically standard in all its parts and dimensions. It is of interest to notice that greater and greater attention has been paid to the detail and finish of these instruments, and at the same time those who have observed the quotations upon such apparatus have noticed that its price has fallen until it is now at that happy minimum which secures the least expenditure for substantial apparatus to the purchaser, without, at the same time, being so low in price as to deprive the manufacturer of his proper profit for its construction.



NATIONAL AUTOMATIC TELEPHONE SWITCH.

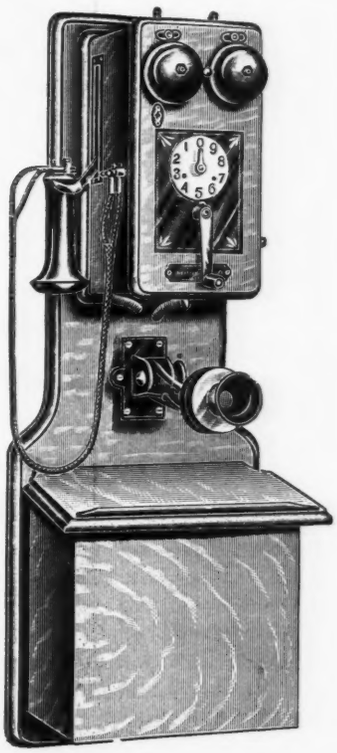
EUREKA SWITCHBOARD SECTION.

EUREKA TELEPHONES.

The accompanying illustration represents a section of switchboard manufactured by the Eureka Electric Company, Incorporated, of Chicago. This board has 350 drops installed, and is of the "Express" pattern with self-restoring drops, also self-restoring clear-outs. The drops themselves are self-contained and removable, and the same features distinguish the clear-outs and cams. Flashlight transfers are employed, the photograph giving an excellent idea of the general appearance of the board and its appurtenances. The board here illustrated has a total capacity of 600 stations.

NATIONAL AUTOMATIC TELEPHONES.

The advantages of automatic telephone systems are too well understood to require extended explanation. In systems of this character the services of operators at the switchboards are dispensed with, automatic apparatus taking their place and making connection as desired by the various subscribers connected. The instrument herewith illustrated is intended for exchange work and is made by the National Automatic Telephone Company, of Chicago. The method of operating telephones of this character is by moving the pointer on each instrument over its dial to the number desired and turning the magneto handle. The connection is entirely automatic in its character and is accomplished by means of step-by-step switches installed in the central office. For the automatic systems it is claimed that numerous advantages of privacy and accuracy are available and that maintenance is less expensive than in the case of systems requiring switchboard operators.



NATIONAL AUTOMATIC TELEPHONE WALL SET.

A NEW CENTRAL BATTERY TELEPHONE SYSTEM.

The accompanying illustrations show the new central battery telephone system constructed by the Western Electrical Supply Company, St. Louis.

The construction and workmanship, as shown in the accompanying illustration of a blank section of a visual-signal multiple switchboard, is a part of a 3,000-number exchange which this company has recently installed. As the illustration shows, the workmanship, general appearance and finish are of high class. The framework is made entirely of iron.

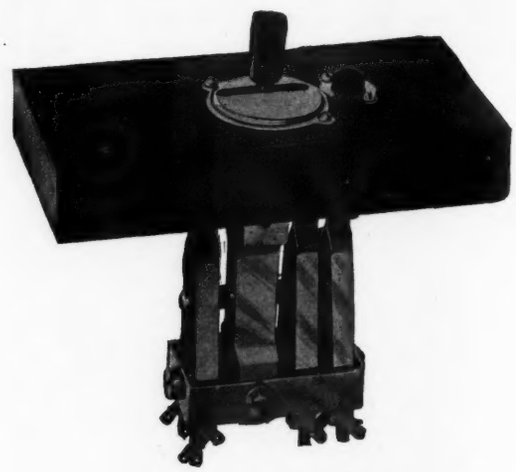
IRON FRAMEWORK OF WESTERN ELECTRICAL SUPPLY BOARD.

All the framework of the multiple switchboards is of substantial angle-iron construction, and of such cross-sections and so braced as to be thoroughly rigid. All angle irons and braces are held in place by bolts and machine screws, thus insuring the stability of the board. The woodwork on the face and ends is of highly polished quarter-sawed oak, thoroughly seasoned and very carefully joined. The moldings used are of neat design, and the general appearance of the board is very attractive.

The back of the switchboard is enclosed in heavy felt curtains, mounted on substantial rollers, with one curtain to each section. These serve to keep out dust from the rear of the board, and also make all parts in the rear of the board readily accessible. The key shelves of each operator's position are hinged separately. These shelves are built of three layers, which eliminate the possibility of their warping.

The circuit changers, being mounted on the under side of this shelf, are encased and excluded from dust or injury. In the upper portion of the board, and immediately back of the iron strips, as shown, are mounted the visual signals. Immediately below these signals are mounted the multiple jacks, while the answering jacks are mounted in the lower panel directly in front of the operator's position.

BLANK SECTION OF A 3,000-NUMBER VISUAL FIGURE BOARD, WESTERN ELECTRICAL SUPPLY COMPANY.



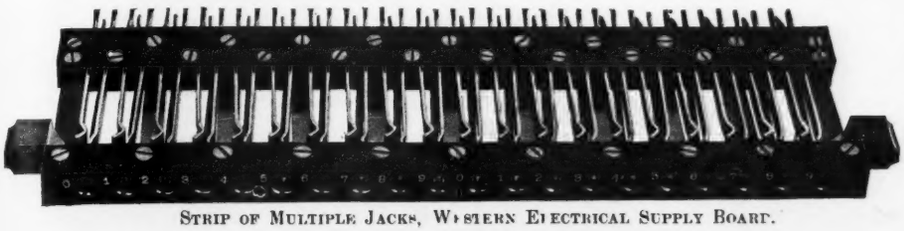
OPERATOR'S LISTENING KEY.

Operation of this system is as follows: The removal of the receiver from the subscriber's telephone hook causes a visual signal to appear in view of the operator and at the same time lights a pilot lamp on the chief operator's desk, who has supervision of the entire exchange at her desk. These signals all remain lighted until the operator inserts the answering plug, when all lights are extinguished.

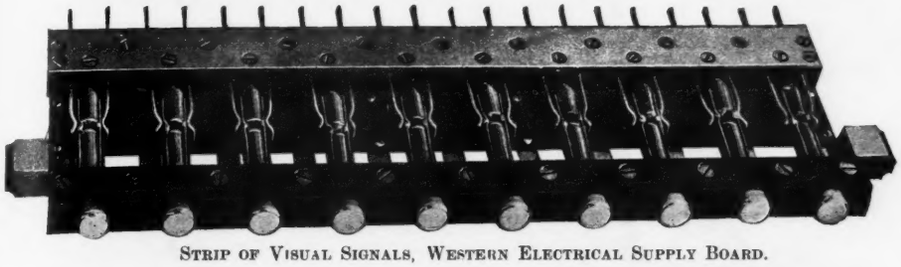
Throwing the listening key forward connects the operator with the calling subscriber and she now asks "What number?" She then inserts the mate plug in the jack of the called subscriber and throws the lever towards her which rings the bell of the desired subscriber. When the conversation is finished and the parties hang up their receivers, miniature incandescent lamps burn; showing that the conversation is ended, and the operator disconnects the line. A simple and reliable "busy" test is provided, which causes a click in the operator's receiver when a busy line is touched with a connecting plug, and the operator informs the calling subscriber that the line is busy.

It is claimed that this system requires less wiring than others, there being only three springs in the multiple jack, which reduces the wiring to three-fifths that of other systems. The switchboard can be used either for local talking battery or central talking battery with absolutely no

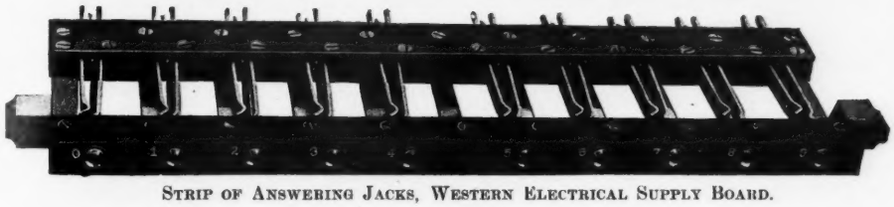
change in the wiring of the board, but in either case the subscriber's call is made by lifting the receiver from the hook. With the improved method of wiring additional sections may be added to multiple boards without cutting or splicing the multiple cables. Another feature is that the spring jack has no contacts; the insertion of a plug automatically shunts out the line signal instead of opening the circuit. When two subscribers are connected in this system, they have a straight connection through, there being no relays, condensers, repeating coils or other apparatus in circuit, and no ground connections are used whatever.



STRIP OF MULTIPLE JACKS, WESTERN ELECTRICAL SUPPLY BOARD.



STRIP OF VISUAL SIGNALS, WESTERN ELECTRICAL SUPPLY BOARD.



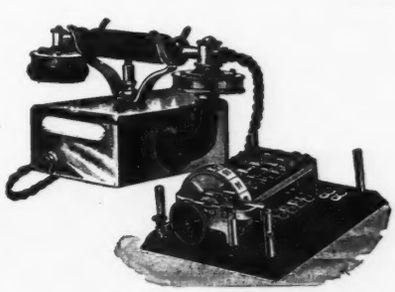
STRIP OF ANSWERING JACKS, WESTERN ELECTRICAL SUPPLY BOARD.

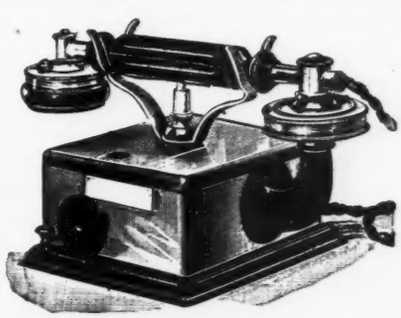
All the insulation is of pure hard rubber. On account of using only three springs instead of five the springs are placed three times the distance apart, which permits of the use of heavy and substantial insulation. Owing to their simplicity the jacks are easily repaired. The only wear to which the jack is subjected is the wear on the shell, and this is designed in such a manner as to permit of replacing it with a new one with the least possible inconvenience. It is not necessary to remove the entire strip from the board to repair one jack.

The construction is full metallic, and will operate equally well on a common return or grounded circuit. Boards are made in any capacity for either lamp or visual signals. This construction has also been adapted for small central energy systems, as shown in the illustration of a 100-line visual-signal central energy system switchboard, equipped with visual signals instead of drops such as are ordinarily used in small magneto call exchanges. This system is a radical departure from other designs of central energy boards. It is said to be especially adapted for small exchanges, and is simple in construction, there being no complicated circuits or apparatus employed.

THE LAMBERT SCHMIDT TELEPHONE MANUFACTURING COMPANY'S APPARATUS.

The accompanying illustrations show various types of telephone apparatus manufactured by the Lambert Schmidt Telephone Manufacturing Company, New York.





FIGS. 1 AND 2.—LAMBERT SCHMIDT INTERCOMMUNICATING TELEPHONE.

The automatic reset or intercommunicating desk telephone is an instrument designed for the accommodation of 15 stations, all similarly arranged. This apparatus is shown in Fig. 1. The base of the apparatus contains the switching mechanism, and on top of this is placed a nickel-plated brass cover carrying a support for the transmitter and receiver. The middle of this double apparatus rests on the top of a long projecting hard rubber button extending inside the cover. The apparatus assembled is shown in Fig. 2. To connect with another telephone in the system, the receiver and transmitter piece is lifted up from the support and the hand knob on the side turned, revolving its centre shaft. On this shaft are arranged a set of pins projecting at different degrees, and, at regular intervals, these pins wipe against stationary springs fastened to a rack on each side of the shaft. As the microtelephone is removed from the support, the button in the centre tube rises, which lets fall a clutch on a cog-wheel at the end of the shaft, this clutch holding the shaft at each arc of the pins. On the shaft is an aluminum wheel with a numbering strip similar to a wheel tire, this strip being divided into sections corresponding with the arcs described by the pins. Directly over this wheel a hole is cut through the metal cover, protected by glass, and the numbers on the wheels are seen as the shaft revolves. Thus when pin No. 5 is brought in contact with spring No. 5, this number shows through the glass. The springs on the rack are of phosphor bronze, and each is connected to a different telephone in the system. The signaling device is a push-button at the side of the cover. When the microtelephone is placed on the support it presses down the long hard rubber button in the tube, which releases the clutch from the cog-wheel, and the shaft is revolved to its normal position by a reversing spring. The rising of this long button also cuts in the talking and cuts out the bell circuit, and the reverse when pressed downward. The cover is removed from the base by the withdrawal of two small screws set in the upright guides on the base.

The wall type is very similar to the desk

type, but arranged so that the hanging up of the receiver on the hook releases the switching device, in place of the laying of the microtelephone across the support as described above.

In Fig. 4 is shown the all-metal type of desk telephone, the switching contacts in this instrument being concealed and the

FIG. 3.—SCHMIDT WALL SET.

body of the stand made of heavy metal. The coil is mounted on a separate block. In Fig. 5 is shown a cross-section of the company's bipolar receiver which possesses several points of novelty. The magnet is of tungsten steel, the bobbins being wound on soft iron cores. The magnet is attached to the shell by a brass place near its poles, thus eliminating trouble from temperature changes. The head of the receiver case is a brass cup, the handle being threaded on to the case, as is shown in the illustration. The binding-posts are peculiarly constructed. The body is an arch with a partially flat top. Inside this arch is a square block, not filling the entire space, and with a long threaded pin extending through a hole at the top of the arch, but not screwed to it; on the contrary, this hole allows easy play. A finger nut is screwed to this pin and is in position directly over the arch. On the opposite sides of the arch are two small holes. There is also a similar hole through the metal block. The block is brought into position so that these three holes are in alignment and the cord tip is then pushed through. The finger nut is turned, thus drawing up the block and clamping the cord tip on each side of the arch so that it can not possibly work loose. The binding-posts have screw-plates to prevent twisting. The finger nut can not work off the threaded pin. Fixture wire is used from the binding-posts to the bobbins.

WILLIAMS ELECTRIC COMPANY'S APPARATUS.

The accompanying illustrations show in detail the construction of various parts of the improved telephone apparatus manufactured by the Williams Electric Com-

FIG. 4.—SCHMIDT DESK SET.

pany, Cleveland, Ohio. In Fig. 1 is exhibited a new type of ringer, the principal improvement in which is the manner of attaching the cores to the yoke. As the

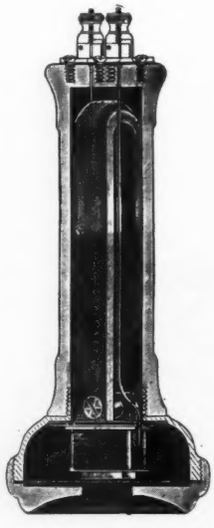


FIG. 5.—SCHMIDT RECEIVER.

illustration shows, the cores shoulder on the yoke and pass through it, being fastened to it by means of steel nuts, thus giving great magnetic service and mechanical rigidity. Adjustment is effected by moving the armature yoke up and down through the bushing in the permanent magnet. For series work this ringer is wound to 80 ohms and for bridging work from 1,000 to 3,500 ohms.

In Fig. 2 is shown the new type of switchboard generator made by this company, Figs. 3 and 4 showing details of its armature construction. The armature is made up of soft iron punchings, thoroughly annealed.

In Fig. 5 is shown a metal head used in the hard rubber shell of telephone receivers. This is made of heavy sheet brass, machined all over and is molded solidly into the rubber, forming practically a part of it. In Fig. 6 is shown the double-pole magnet of the receiver. The spool-carrying disk has three double springs around its periphery which always press upward against the adjusting screws, giving a very rigid form of construction and making it difficult for the screws to work loose. As the cores are mounted so near the diaphragm, temperature changes made no difference in the adjustment of the instrument. The cross-section of the permanent magnet is semi-circular so as to permit a snug fit in the receiver shell. Fig. 7 shows the general type of the company's long-distance swinging arm transmitter. The induction coil is concealed in the base of the instrument and the cord passes through the hollow swinging arm. Figs. 8 and 9 are, respectively, a complete receiver with its spring-lock binding-posts, and an end view of the adjusting screws, coil disk and magnet spools of the receiver.

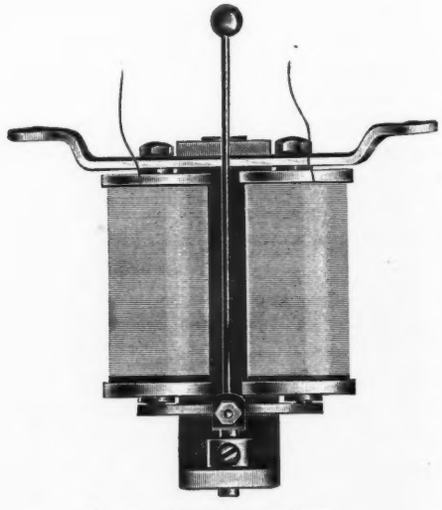


FIG. 1.—WILLIAMS RINGER.

CENTRAL TELEPHONE AND ELECTRIC COMPANY'S APPARATUS.

The accompanying illustrations represent types of telephone apparatus manufactured by the Central Telephone and Electric Company, of St. Louis, Mo. In Fig. 1 is shown a desk set, the illustration

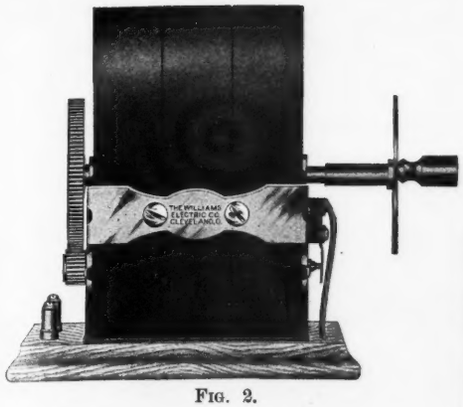


FIG. 2.

FIG. 6.

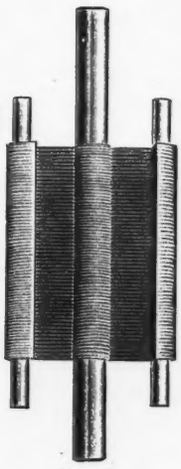


FIG. 3.

FIG. 4.

FIG. 5.

FIG. 9.

FIG. 8.

FIGS. 2-9.--WILLIAMS ELECTRIC COMPANY'S APPARATUS.

speaking for itself in showing the elegance of design and simplicity of this apparatus. The contacts of the lever in this set are of platinum. In Figs. 2 and 3 are shown, respectively, closed and opened to expose the coils of the ringer in the magneto, a wall set made by the same company. These instruments comprise the various specialties in long-distance and high-power telephone apparatus made by its manufacturers, and special attention is paid in them to the detail of the woodwork and the appearance of the instruments. This can best be judged by an inspection of the illustrations. The transmitter shown in connection with these wall sets is claimed to be of very high power and adapted for talking over circuits of length. It will be noted that in this design the receiver and magneto handle are convenient to the two hands of the user when his mouth is at the transmitter.

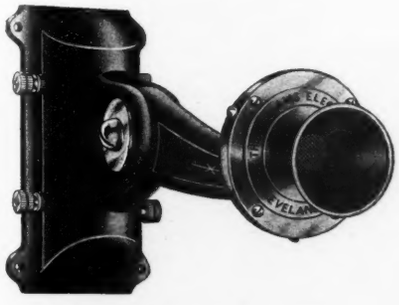


FIG. 7.—WILLIAMS TRANSMITTER.

THE ERICSSON TELEPHONE COMPANY.

The Ericsson Telephone Company is well known as an importer of telephone apparatus manufactured in Sweden. The accompanying interesting illustrations of two of the foreign exchanges equipped with this apparatus almost tell their own story. In Fig. 1 is shown the multiple switchboard in the Ericsson company's exchange at Shanghai, China. It will be noted that Chinese men are used as operators. They are said to be very rapid and accurate. So far, the exchange in that city has only 600 stations installed, but the board being on the multiple system its ultimate capacity is 5,000 subscribers, and new sections are to be installed at once.

While the "chief" is a lady operator, and was imported from Sweden with the switchboard, the others are all native men. It is said that they are remarkably apt in

FIG. 1. FIG. 2. FIG. 3.

FIGS. 1, 2 AND 3.—CENTRAL TELEPHONE AND ELECTRIC COMPANY'S APPARATUS.

learning to operate, quick in their movements and naturally patient and persistent, and they readily become expert operators.

The operation of the Ericsson full multiple switchboard is extremely simple, each section being divided into five panels for convenience, and in large boards an annex is placed at each end. The plugs and cords are placed on two different planes, the answering below and the calling above, which is of great advantage to the operator, as the answering jacks are just above the answering plugs, thus operating them entirely from the calling plugs and multiple jacks. In case of a call the operator answers and can connect directly from her own division with any other subscriber in the board, thus giving very quick service and saving the time of the calling subscriber and of the other operators.

Each operator has 18 pairs of cords and plugs, which provide for the busiest exchanges. The board is so made that busy subscribers' lines can be removed from one operator to another, thus distributing the work quite evenly. Each operator has a counter, which records automatically all the outgoing calls from her division of the board. It is said that this will be made a model exchange, and additional sections are on the way to Shanghai now, which will increase the size of the board; other sections are to be supplied as may be required.

Fig. 2 is an interior view of one of the most beautiful telephone exchange rooms in the world, that at Copenhagen, Denmark. This exchange has a capacity of 10,000 subscribers. It will be noted that nothing has been spared to make the decorations of this room beautiful, while the general convenience of the arrangement which puts the monitor operators in the middle with the trunk-line operators on both sides will commend itself to practical telephone people.

FIG. 1.—ERICSSON MULTIPLE SWITCHBOARD AT SHANGHAI, CHINA.

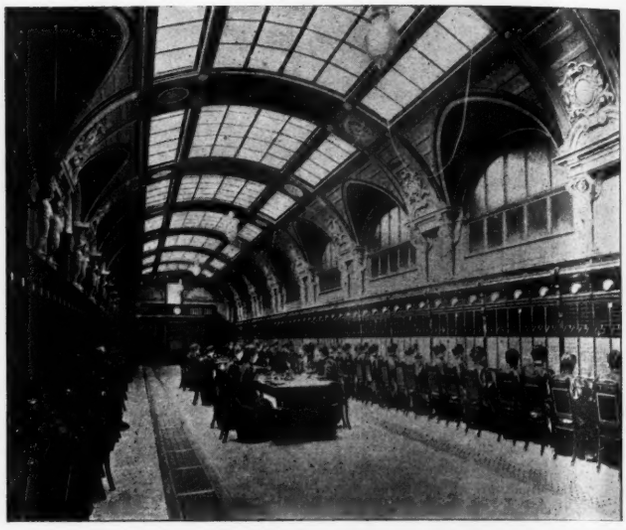


FIG. 2.—ERICSSON MULTIPLE SWITCHBOARD IN COPENHAGEN, DENMARK, EXCHANGE. CAPACITY, 10,000 LINES.

THE WESTERN TELEPHONE CONSTRUCTION COMPANY'S APPARATUS.

In the accompanying illustrations are shown a few of the telephone apparatuses manufactured by the Western Telephone Construction Company, of Chicago, Ill. In Fig. 1 is shown the Western express wall-set telephone, which is the standard type constructed by this company. The particular features of this apparatus are

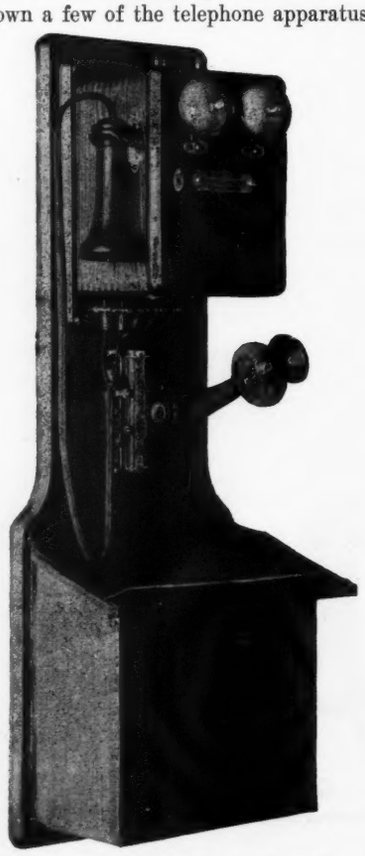


FIG. 1.—WESTERN EXPRESS WALL SET.

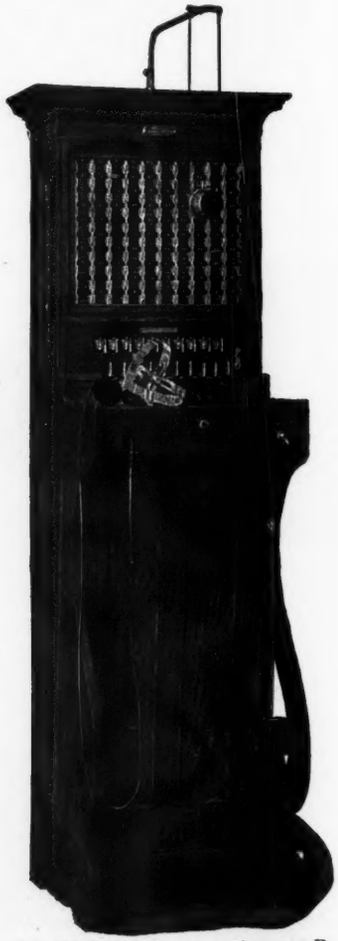


FIG. 2.—100-DROP WESTERN EXPRESS BOARD.

noticeable in the receiver, which is of entirely new design, the cord being attached to terminals inside, and no binding-posts or anything of a metallic nature being used in the outside construction. This receiver is of the double-pole type. The transmitter is of the solid-back type mounted on an adjustable arm, the induction coil being in the base of this arm. All of the contact points are platinum and the springs are of German silver.

STANDARD TELEPHONES.

The switchboard, of the manual type, and desk set herewith illustrated are manufactured by the Standard Telephone and Electric Company, of Madison, Wis. The switchboard is of the type in which the clearing-out signals are automatically restored. It is equipped with improved keys, tubular clearing-out drops, and lever restorers for the subscribers' drops. The desk set illustrated is made of mahogany or ebonized wood and is stated to be very light and easily handled, while at the same time exceedingly compact.

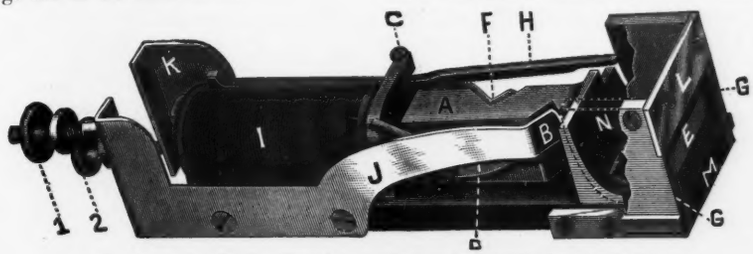
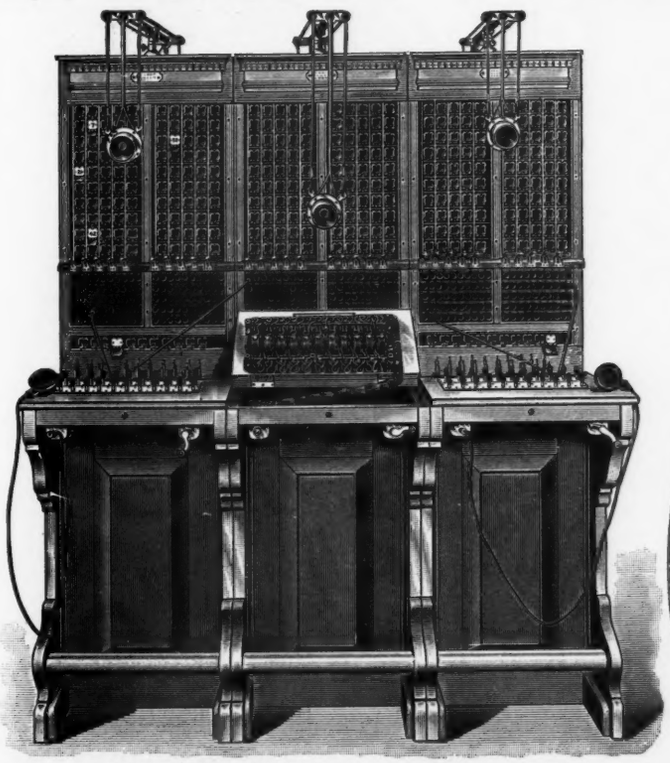


FIG. 3.—SELF-RESTORING MECHANISM OF EXPRESS SWITCHBOARD.

In Fig. 2 is shown a 100-drop express switchboard equipped with combined self-contained and removable spring jack, drop and coils. This board embodies the type of construction which was adopted by this company several years ago in its early work in the independent field. An examination of Fig. 3, which shows the combined self-restoring spring jack, drop and coil, easily shows the method of operating this board. The drop is self-restoring, the operation of plugging-in accomplishing its restoration. These boards have been in use for a long time and have withstood much hard service with satisfactory results.



STANDARD MANUAL SWITCHBOARD.

STANDARD DESK SET.

Telephones in Havana.

Mr. A. F. Blundell, the manager of the telephone companies in Havana, Cuba, is in the United States to obtain 2,500 automatic instruments for use in that city. While in Chicago, Mr. Blundell is reported to have said: "Telephones there are in greater use than in any American city of similar size. The warm climate and the habits of the people unite to make telephones a necessity. Capital in all lines of business is waiting."

The Great Importance of Steel and Iron.

Dr. A. S. Kennelly added, after reading his paper on the Edison storage battery before the American Institute of Electrical Engineers:

"Summing up, then, you will observe that the substance of which the cell is composed is steel, that substance which is so enormously important in engineering generally. It is steel and iron that produce the structures of mechanical and civil engineering. It is steel and iron that have given us dynamos and dynamo-electric machinery and the transmission of electrical power. Without steel or iron we would not be able commercially to employ electricity in such applications. Let us hope that steel and iron may be the foundation of a great improvement in the storage cell. By a curious coincidence all the active substances in this cell are distinctly magnetic—iron, steel and the working substance, oxygen. The real difficulty presented, as Mr. Edison states it, was in finding salts of iron and nickel which would work, which would not remain passive, and I understand him to say that he has practically had to find new substances, in the sense of substances not recognized or known—new salts which would be capable of activity and of charging and discharging in this way."

Mr. Yerkes Disposes of His Chicago Railway Interests.

Before sailing for London a few days ago, Mr. Chas. T. Yerkes disposed of every street and elevated railway interest owned by him in the city of Chicago, Ill., receiving in exchange for his securities $8,000,000 in cash and ending his connection with the various lines. Mr. Yerkes's interests were of 14 years' standing. The purchasing syndicate, which is composed of Messrs. John J. Mitchell, Marshall Field and Blair & Company, of New York, took all of Mr. Yerkes's holdings in the Union Loop Company, which were purchased for $5,000,000. He also held practically all the certificates of the Suburban Railway Company, which is capitalized at $1,250,000. It is stated that Mr. Yerkes obtained par for his holdings, the purchaser being the Chicago Union Traction Company, which also took up about $1,000,000 of West Chicago Street Railway stock and about the same amount of stock in the North Side line.

A New Type of Railway Generator.

The essential element in a railway generator is that it shall commutate varying loads without sparking and have a factor of safety in its design which will allow of severe overloads being thrown on the generator without damage or depreciation to the machinery. A generator to meet the exacting demands required in street railway work is the outcome of experience, as its design is not comprehended in any formula or rule of thumb. In view of these facts, a description of the new Thresher engine-type generator will be of interest. This machine has been reduced to its simplest form and all complications removed which would make its maintenance and repair difficult.

The field ring of the generator is a special grade of cast iron of high permeability, the polar projections being separable to allow the field coil to be removed without dismantling the balance of the machine. The pole-piece is proportioned to overcome, as far as possible, the armature reaction. The joint is scraped to an exact bearing to decrease the reluctance to a minimum, and the pole-piece is firmly bolted in position. This method of construction gives a perfectly balanced field, the reluctance being the same in each circuit and the pole-pieces exactly spaced, which can not be obtained where the pole-pieces are cast into the ring.

The field coils are wound on metallic shells and are insulated with moisture-excluding material. The series and shunt coils are wound entirely separate, to allow of perfect ventilation, and, in case of accident to either, to permit of the damaged part being repaired without disturbing the other windings. In the armature construction the features sought have been compactness, solidity and perfect ventilation.

Fig. 1 shows the completed armature. As will be seen, the windings are entirely on the periphery of the armature. Each armature circuit consists of a continuous copper bar, without joint, formed to shape and completely insulated before being placed on the core, the only joint being where the winding is soldered to the commutator leads at a point easily accessible for inspection and repair. The coils are held in position in the slots by wedges, so that no bands are required upon the core body. This form of winding has many advantages as will be readily appreciated. It greatly increases the efficiency of the armature by giving the least possible length of circuit, reducing the internal resistance to the lowest limit, and, by offering a greater radiating surface, makes a cooler running armature. It also makes the removing and replacing of a coil a very simple operation, as a new coil can be inserted by exposing the surface of the armature covered by two pole-pieces, without at all dismantling the balance of the machine.

The commutator is built up on a separate bush carried on the armature spider, so as to be easily removed and replaced by a new one when necessary. The commutator bars are drawn from the best lake copper and insulated with India mica of such character as to wear evenly with the bars. The bars are of such dimensions as to give a large wearing depth, insuring a long life to the commutator. They are firmly held in position by the end flanges, and after being put through the several processes used in their construction, a loose bar is claimed to be impossible, insuring a very smooth running commutator.

The brush holders are of the radial type. Each brush is firmly clamped in a socket at the outer end of an independent arm, working freely upon the supporting stem. An even and constant pressure upon the commutator is maintained by a spring, adjusted through a ratchet on the arm and attached at its lower end to a central portion, fitting closely to the stem and held in position by a pawl. This spring is insulated from the holder to avoid its acting as a conductor and becoming heated so as to destroy its temper.

The stem carrying each set of brush holders is supported by a yoke projecting from an adjustable ring of rigid construction and from which it is thoroughly insulated, provision being made for adjusting each set of brushes independently. This ring is supported concentrically with the commutator by arms extending from the field frame and provided with a worm adjustment operated by a hand-wheel at the side of the ring, as shown in Fig. 2.

The brushes, which are of a special grade of graphite carbon, are proportioned to give a contact surface on the commutator of one square inch for every 28 amperes carried at full load.

All parts of the generator designed to act as conductors are so proportioned as to carry the full rated output without increasing in temperature more than 40 degrees centigrade above a room temperature of 20 degrees centigrade; in the commutator more than 45 degrees centigrade. The regulation is stated to be perfect throughout the whole range of load and no adjustment of the brushes is required with a change of load from zero to fifty per cent overload.

Fig. 1.—Armature Core Complete—Enlarged View.

Fig. 2.—Field and Brush Holders.

Current Electrical News

Commercial News

EXPORT AND DOMESTIC

Durban, South Africa, is seeking to raise $700,000 for the extension of electric tramways and about $400,000 for the purpose of extending the local electric light plant.

A plan is reported to have been drawn up for the purpose of converting the horse tramways in Nicolaieff, a city of some 75,000 inhabitants in southern Russia, into electric lines.

Application for a receiver for the Gordon Battery Company, of New York, has been made on complaint of Mr. R. W. Gordon. The company was incorporated under the laws of Maine with $350,000 capital stock, its officers being Charles E. Lockwood, president, and F. T. C. Haskell, secretary.

An order for telephones and telephone apparatus has come to the United States from England for the British post office. It will reach a total, roughly, of $1,000,000. The firm which received this order states that it is merely an advance or trial order, and that heavier consignments will go forward soon.

The American Telephone and Telegraph Company, at a meeting of its stockholders in New York city, June 3, voted to increase its capital stock from $100,000,000 to $150,000,000, for the purpose of extending the company's lines and enlarging its operations. A circular will be issued very shortly and it is expected in financial circles that the circular will offer $21,000,000 of new stock to shareholders at the rate of one share of the new stock for three of the old.

The Germans, who, with the English, have so long held commercial supremacy in Mexico, are now said to be feeling the inroads of American capital and enterprise in that country so keenly that overtures have been made to the German Government, with a view to having the Deutsche Bank, one of the strongest and broadest banking institutions in Continental Europe, open a branch establishment in the City of Mexico, in order to make an effort to retrieve some of their lost trade.

Experiments made during the month of April in Germany between the cities of Berlin and Hamburg with the Rowland system of rapid telegraphy are stated to have been most satisfactory, the new system easily accomplishing twice the work done by the old Baudot system. It is understood that the German Postal Department will introduce the Rowland system between Berlin, Hamburg, Cologne, Leipzig and Frankfort. This system, which was invented by the late Professor Henry A. Rowland, makes possible the transmission of eight simultaneous messages over a single wire, four in each direction at the rate of 40 words a minute, the messages being sent by means of a keyboard similar in appearance to that of a typewriter.

The city of Merida, capital of Yucatan, Mexico, will shortly have a modern electric traction system, Arturo Castillo Rivas, a local contractor, having secured a concession from the State Legislature. There is at present operated in that city and its immediate surroundings some 50 miles of mule tramways. It will be recalled that the contract for the electric lighting of Merida was recently awarded to the Siemens & Halske Company, the German company which installed the City of Mexico electric lighting plant. The power-house and equipment for the projected road, it is estimated, will mean an expenditure of some $200,000, and last advices from Yucatan lead to the conclusion that all the requisite material, equipment, etc., required for the new road will be purchased in the United States.

Hon. John H. Grout, consul at Malta, advises American firms to have their representatives call at Malta. He states that the demand for American goods is increasing, but this is not due to the presence of personal representatives. He says: "With one exception (and in this case the best results were attained), I have not heard of or seen an American drummer during my stay here, nearly four years. I am prompted to make this suggestion from the fact that for the past few weeks representatives of English and German firms have been at work here and have secured large orders. Why should not American agents do equally as well? Catalogues and price lists are useful, and from the large numbers that I have received and distributed, much business has resulted; but not nearly as much as if personal representatives had been here. Many American drummers travel in Italy; it is an easy matter to reach Malta from that country, there being frequent steamship connection from Genoa, Naples, and Sicilian ports. Those having Adriatic ports in their itineraries will find it very easy to secure passage from here to those points. There is also frequently steamship connection with Alexandria, Tunis, Constantinople, and other places. The direct communication which Malta now has with New York by the Mediterranean Steamship Company is a great factor in the increase of our trade here, and should be taken advantage of. Ships are despatched regularly from New York, the voyage taking about 20 days (much less than when goods are sent *via* English and German ports), and freight rates are lower."

Telephone and Telegraph

A franchise has been granted by Frankfort, Ohio, to the Ohio Telephone and Telegraph Company to maintain a telephone toll system in that village.

Reports from Hutchinson, Kan., state that the city council has granted a franchise for a new telephone company, the term of the agreement being 21 years. Messrs. Bellamy & Burns represent the telephone people.

Construction work on the extensions of the Citizens' Telephone Company, of St. Johnsbury, Vt., has been begun on the line which will touch Wells River. Other extensions will be begun in the near future.

Cartersville, Va., is soon to be connected with Richmond by telephone, as the Fluvanna Telephone and Telegraph Company will extend its line to Cartersville and through Powhatan and Chesterfield counties into Manchester and Richmond.

A franchise and permission to operate have been granted by the village council of Cloquet to the Zenith Telephone Company, of Duluth, Minn., which will establish service there in the near future. The lines and system must be completed and in working order by July 1.

At a recent meeting of the directors of the Central District and Printing Telegraph Company, of Pittsburgh, Pa., it was determined to erect a three-story building for a central telephone exchange at Fourth avenue and Cherry alley. The building will be completely occupied by the telephone company, which in its present quarters is cramped and unable to give full attention to its increasing business.

A new telephone line is to be constructed between the city of Albuquerque, N. M., and the town of Sandoval, formerly known as Los Corrales, the promoter being Señor Mariano Armijo. It is believed that the system will be in operation within a week or two. Automatic instruments are to be used and the construction work has been carried on under the supervision of the company which manufactured them.

The recently incorporated Saratoga, N. Y., Telephone and Telegraph Company will operate throughout Saratoga, Washington, Warren, Montgomery, Fulton, Scoharie and Rensselaer counties in New York. The company's capital is $125,000, and its directors are: Frederick H. Beach, Stephen C. Medbery, Irving W. Wiswall and Herbert C. Westcott, of Ballston, and Charles W. Cool, W. Levis Burk and William F. Bentley, of Glens Falls.

Electric Lighting

A company has been organized in Harrison, Tex., to maintain an electric lighting plant.

The Jersey Shore, Pa., Electric Street Railway Company has leased the plant of the Jersey Shore Electric Light Company for a term of 30 years.

A plant is soon to be erected in Richmond, Ky., by the Richmond Water and Light Company at a cost of about $16,000. The plant will light the entire town.

A double turbine has been added to the equipment of the Thornapple Valley Electric Light and Power Company of Michigan, thus increasing its capacity to 500 horsepower.

An electric lighting franchise has been granted by Woodstock, Va., to the Woodstock Electric Light Company, which will operate an electric lighting plant in connection with waterworks.

The old electric light plant in Fort Scott, Kan., has been abandoned and the new service for city and commercial lighting has been installed. The company's plant is now equipped with thoroughly modern apparatus and its motive power is furnished by duplicate engines.

Sealed proposals for furnishing an electric light plant for Fort Greble, R. I., will be received at the United States Engineer Office, Newport, R. I., until June 19 at 11 A. M. Further information may be obtained from Major George W. Goethals, Engineer Corps, United States Army.

By an agreement between the stockholders of the two companies, the New York Gas, Electric Light, Heat and Power Company, and the Edison Electric Illuminating Company, both of New York city, both organizations have been merged into the New York Edison Company, with a capital stock of $45,200,000.

New Incorporations

WILMOT, OHIO—Valley Telephone Company. $1,000.

MONROE, MICH.—Monroe Traction Company. $10,000.

YATES CITY, ILL.—Ideal Telephone Exchange. $2,000.

CHILLICOTHE, ILL.—People's Telephone Company. $4,000.

WAKARUSA, IND.—Wakarusa Telephone Company. $10,000.

WASHINGTON, D. C.—Observation Automobile Company. $100,000.

LETT'S CORNER, IND.—Lett's Corner Telephone Company. $675.

ST. JOSEPH, MICH.—Michigan Electric Railway Company. $25,000.

SPRINGFIELD, OHIO—Springfield Home Telephone Company. $300,000.

VIRGINIA BEACH, MD.—Atlantic Light and Water Company. $500,000.

CLARENDON, TEX.—Clarendon Electric Light and Power Company. $6,000.

LIMA, OHIO—Lima, Lewiston & Bellefontaine Railway Company. $10,000.

STRONG STATION, MICH.—Easton Independent Telephone Company. $1,000.

MUNCIE, IND.—Muncie, Middletown & Greenfield Traction Company. $25,000.

TAYLORSVILLE, KY.—Taylorsville & Bethlehem Telephone Company. $10,000.

CRAIG, MO.—Craig Telephone Company. $1,000. Incorporators: F. K. Allen and others.

TROY, N. Y.—Troy, Rensselaer & Pittsfield Railway Company. $300,000. Directors not named.

HARTFORD, KY.—Hartford & Beaver Dam Electric Light, Railway and Power Company. $50,000.

LIMA, OHIO—Lima, Delphos, Van Wert & Fort Wayne Traction Company. Capital stock not stated.

CYNTHIANA, KY.—The Cynthiana Telephone Company has increased its capital stock to $30,000.

CORINTH, ILL.—Crab Orchard Telephone Company. $2,000. Incorporators. J. L. Roberts and others.

BURTON, GEAUGA COUNTY—The Burton Telephone Company has increased its capital stock to $5,000.

NEW PHILADELPHIA, OHIO—Tuskarawas County Telephone Company. $200,000. Incorporators not stated.

POLO, ILL.—Independent County Telephone Company. $20,000. Incorporators: W. P. Graham and others.

CORNING, N. Y.—The Gas and Electric Company. $375,000. Directors: A. W. Cole, L. B. Grant and N. L. Merry.

WATERTOWN, N. Y.—Eager Electric Company. $10,000. Directors: F. M. Bosworth, Henry Eager and others.

MILWAUKEE, WIS.—Kurtz National Telephone Company. $25,000. Incorporators: J. W. Murphy and others.

CHANCEFORD, PA.—Chanceford Telephone Company. $50,000. Incorporators: H. Ross, E. W. Keyser and others.

CHILLICOTHE, ILL.—People's Telephone Company. $4,000. Incorporators: B. F. Zinser, H. L. Pettet and D. Kelly.

CHARLOTTESVILLE, IND.—Charlottesville Rural Telephone Company. $200. Directors: Daniel Pearson and others.

GALESBURG, ILL.—People's Traction Company. $10,000. Incorporators: E. B. Hardy, F. W. Latimer, L. W. Sanborn.

ROCHESTER, N. Y.—The Citizens' Light and Power Company has increased its capital stock from $1,500,000 to $2,500,000.

NASHVILLE, TENN.—People's Telephone Company, of Stewart County. $3,000. Incorporators: W. T. Thomas and others.

STREETER, ILL.—People's Light and Railway Company. $150,000. Incorporators: W. V. Coons, C. C. Barr and W. H. Boys.

SPENCERVILLE, OHIO—Spencerville (Allen County) Telephone Company. $20,000. Incorporators: A. C. Burr and others.

COLUMBUS, OHIO—Electric Depot Company. $200,000. Incorporators: E. G. Tillotson, H. A. Everett, E. W. Moore and others.

GOLDEN BRIDGE, CT.—Golden Bridge Electric Railroad Company. $100,000. Directors: E. B. Brady, H. I. Howe and others.

NEWARK, N. J.—Federal Development Company. $200,000. Incorporators: J. P. Barielow, C. V. Childs and J. R. Mapletoft.

HIAWASSEE, TENN.—Hiawassee Telephone and Electric Company. $10,000. Incorporators: C. Seymour, W. W. Lee and others.

MEXIA, TEX.—Mexia Electric Light and Power Company. $16,000. Incorporators: J. R. Cravens, J. H. Shelly and T. S. Miller.

GALESBURG, ILL.— People's Traction Company. $100,000. L. W. Sanborn, president; F. W. Latimer, secretary and treasurer.

ASHDOWN, ARK.—Interstate Telegraph and Telephone Company. $50,000. Incorporators: W. M. Freeman, F. A. Locke, L. A. Byrn.

FAIRPORT, N. Y.—Fairport Electric Railway Company. $110,000. Directors: C. A., D. E., C. F. and A. C. Lux, C. H. Ford and others.

RIVERSIDE, CAL.—Riverside Power Company. $250,000. Directors: C. W. Rogers, W. D. Clements, Myron Alguire and others.

VENANGO, N. J.—Venango Power and Traction Company. $1,000,000. Incorporators: C. E. Loane, P. E. Dudley and others.

LANSING, MICH.—Detroit, Howell & Lansing Railway Company. $500,000. Incorporators: John Winter, O. Lau and H. Warren.

PAULSBORO, N. J.—Paulsboro Trolley Company. $250,000. Paid-up capital $26,000. Incorporators: G. G. Lowes and P. G. Talman.

COLUMBUS, OHIO—The Columbus, Delaware and Northern Traction Company has increased its capital stock from $10,000 to $1,000,000.

DETROIT, MICH.—People's Telephone Company. $2,500,000. Directors: H. Stevens, C. L. Palms, H. A. Everett, E. W. Moore and others.

PIERRE, S. D.—Federal Wireless Telephone and Telegraph Company. $5,000,000. Incorporators: A. B. Davis, S. Lee and W. A. J. Seals.

NEWARK, N. J.—Antiseptic Telephone Appliance Company. $500,000. Incorporators: E. S. Chamblers, T. A. Hickey and P. W. Rider.

CINCINNATI, OHIO—Cincinnati, Venice and Electric Railway Company. $10,000. Incorporators: W. Christie, O. V. Parrish and others.

ALBANY, N. Y.—The Warren County Railway Company will increase its capital stock soon to $500,000 and issue a first mortgage for $600,000.

SAN ANTONIO, TEX.—Commercial Telephone Company. $500,000. Incorporators: Z. B. Campbell, J. E. Boynton, C. M. Haskell and H. M. Aubrey.

MARTINSVILLE, IND.—Indianapolis & Martinsville Rapid Transit Company. $100,000. Incorporators: C. F. Smith, A. T. Irwin, A. Goetz and others.

PIPESTONE, MINN.—Pipestone Electric Light, Heat and Power Company. $50,000. J. D. Nerney, president; F. P. Wilson, secretary and treasurer.

INDIANAPOLIS, IND.—Indianapolis & Southwestern Traction Company. $50,000. Directors: J. E. Lowes, R. E. Field, H. J. Brandon and others.

HALL'S FERRY, MO.—Hall's Ferry & Des Peres Belt Line Railroad Company. $50,000. Directors: J. Padfield, E. Henry, J. D. Morse and others.

INDIANOLA, I. T.—Indianola Telephone and Telegraph Company. $200,000. Officers: C. N. Haskell, president; W. T. Hutchins, secretary and treasurer.

HAMILTON, OHIO—Hamilton, Oxford and Western Electric Street Railway Company. $10,000. Incorporators: W. Christie, O. V. Parrish and others.

CLOQUET, MINN.—St. Louis River Power and Improvement Company. $100,000. Incorporators: F. E. Poole, R. M. and F. E. Weyerhaeuser and others.

DELEA, MISS.—Delea Electric Light, Power and Manufacturing Company, of Greenville. $50,000. Incorporators: C. M. Ham, W. E. Hunt and others.

KEMP, KAUFMAN COUNTY, TEX.—Texas Telephone and Telegraph Company. $20,000. Incorporators: G. Mason, A. J. Still, Jr., E. O. Jones and others.

ALTON, ILL.—Alton, Edwardsville & East St. Louis Railway Company. $25,000. Incorporators and directors: E. W. Mudge, J. E. Flynn, J. W. Scott and others.

FINDLAY, OHIO—Findlay, Columbus Grove & Fort Wayne Electric Railway Company. $50,000. Incorporators: J. H. Whistler, H. M. Day, C. E. Niles and others.

Literary

The Century for June contains Ex-President Cleveland's discussion of the "Venezuelan Boundary Controversy," the present paper being the first of the series. The current issue of the *Century* is styled a "college number," and as such devotes a good portion of its space to matters current in the collegiate world.

Scribner's for June contains a number of valuable contributions, among which are: "A Section-Hand on the Northern Pacific Railway," Walter A. W. Wyckoff; "Passages from a Dairy in the Pacific," John La Farge; "An Old Home" (Amateur Cracksman series), E. W. Hornung, and many others of equal interest. Mr. La Farge has drawn the frontispiece to illustrate his story.

Electrical Securities

It is the opinion of wise and conservative observers that another period of unhesitating purchasers for investment as well as of extensive speculation will be seen in Wall street. Where the supply of stocks is so small and where so large a short interest has accumulated advance in prices that occurred during the past week must be looked for. Very marked attention is being paid to the leading railroad stocks, particularly the Atchison, which shows enormous earnings. The formal announcement that the dispute between the Northern Pacific, Great Northern and Union Pacific directors had been absolutely settled was probably the most important technical event of the week in the financial world. This results in a far closer, more elaborate and permanent arrangement for the maintenance of railway rates and is the evidence of the end of serious competition. The supply of money in the country for all present purposes of investment and speculation is more than ample. The New York *Sun* states that money is flowing to this centre and that this is usual at this time of the year, and that there will not be any interior demand for it for business or crop purposes until fall. Therefore money brokers are offering funds at low rates, nearly as low as has ever been known. Our agricultural exports have been very large while our imports of raw material have declined. The steel stocks and amalgamated copper were exceptionally strong during the past week.

ELECTRICAL SECURITIES FOR WEEK ENDING JUNE 1.

New York:	Highest.	Lowest.	Closing.
B'klyn R. T.	81⅝	75⅝	81⅝
Con. Gas.	224	218	222½
Gen. Elec.	233¼	229	233¼
Man El.	120¼	113	120¼
Met. St. Ry.	173⅝	167¾	173½
Third Ave. R. R.	124	124	124
Kings County Electric	...	...	195
N. Y. and N. J. Tel. Co.	...	...	174
Telep., Tel & Cable Co.	...	...	6¼

Consolidated Gas of New York is steadily bought by insiders. It is stated that it will touch 300 before the end of the year. This company controls the electric lighting as well as the gas interests of New York city.

New York Electric Vehicle Company, through President H. Sanderson, announces that its new Fifth avenue stages will be ready by August 1, and that these stages will run over routes aggregating 22 miles, making 10 miles an hour. The new "exide" type of battery will be used and Mr. Sanderson announces that it weighs 62 pounds per electric horse-power hour as against 124 pounds of the former type. The stock of this company is still very low, due to the assessment of $10 per share which is to be paid June 15. The company, however, is reported to be doing a very successful business. The last sale of the stock was 1½.

Brooklyn Rapid Transit was somewhat heavy last week evidently effected by the bad weather. Insiders state, however, that the earnings are well up to last year's and the company is working at a very materially cheaper rate.

The story of an extra payment to the General Electric stockholders was again current last week. Insiders are very bullish on the merits of this stock.

The developments in the Edison storage battery are watched with considerable interest. Mr. Edison has been elected president of the company, which will be known as the Edison Storage Battery Company. Mr. John F. Randolph was elected secretary and treasurer. The directors of the company have not yet been announced.

The Washington, D. C., Traction and Electric Company, largely owned in New York city, has defaulted on its bond interest and reorganization will at once be undertaken.

Boston, June 1:	Closing.
Am. Tel. and Tel.	174
Erie Tel.	58⅛
New Eng. Tel.	142
Mass Elec. c.	35⅛
Westing. Elec. pf	63⅛
Edison Elec.	260

The Boston market was broader and stronger than in some time past. The copper market was much improved. Interest in the new issue of stock of the American Telephone and Telegraph was quite evident. This is a favorite stock with Boston investors.

Chicago, June 1:	Closing.
Chicago Edison Light	175
Central Union Telephone	48
Chicago Telephone	260
Un. Trac.	18¼
Un. Trac. pf.	58
Metropolitan El.	169⅝

The consolidation of the elevated railroads in Chicago is said to be progressing satisfactorily. There is some doubt about the Metropolitan and South Side Railroads joining the scheme.

It is semi-officially stated that the purchase of the Chicago Edison Company by the People's Gas is probable in the future, but the matter will probably not be taken up until fall.

Philadelphia, June 1:	Closing.
Elec. Co. of A.	8¼
Philadelphia Elec	5⅝
Union Traction	29⅝
United G. I. Co.	116
Elec. Sto. Bat. c.	55
Elec. Sto. Bat. pf.	55

The Philadelphia market was dull nearly all the week. Electric Storage displayed further weakness but made recovery. There was a fair demand for Electric of America. Union Traction was heavy on account of the proposed legislation at Harrisburg which, if carried through, would virtually permit overhead or underground electric street lines on any thoroughfare not occupied. It was thought this would seriously affect the railways in both Philadelphia and Pittsburgh.

Obituary Notices

MR. HARRY FONDERSMITH, a veteran division telegraph operator on the Pennsylvania Railroad, died on May 26, in Wynnewood, Pa. Mr. Fondersmith was born in Chester County, Pa., in 1846, and in 1863 entered the service of the Pennsylvania company as an operator, serving in almost all the offices in the Philadelphia division until 1872, when he was appointed to the position which he held until his death.

MR. J. W. DICKERSON died on Thursday of last week at St. John's Hospital, Brooklyn, N. Y., where he had been ill for about two weeks. Mr. Dickerson was born in 1861, and has been identified more or less closely with electrical journalism for 10 or 12 years. In 1886 he went to Chicago from Rochester, N. Y. Soon after he joined the editorial staff of the *Western Electrician*. He left that publication to become the editor of *Electricity* and thereafter was identified with the *Street Railway Journal* and the *Street Railway Gazette*, of Chicago. He came to New York in June, 1894, and was connected with the *Street Railway Gazette* and the *Electrical World* until he was compelled, on account of his health, to go to Denver where he made his home for the next three or four years, occasionally visiting his friends in the East. He had only recently returned to New York city to engage again in newspaper work. Mr. Dickerson's friends will always remember with pleasure his unfailing good nature and cheerful disposition; his staunch loyalty to his friends and his strict integrity in all business dealings.

Personal Mention

MR. J. C. KILMER has been appointed chief engineer of the Columbus, Huntsville & Northwestern Railroad, of Huntsville, Mo.

MR. EDWIN H. LAKEWOOD has been appointed assistant professor of mechanical engineering at the Sheffield Scientific School, Yale University.

MR. WILLIAM PESTELL, late electrical engineer of the Lynn & Boston, Mass., Railroad, has been appointed superintendent of motive power of the Worcester, Mass., Consolidated Street Railway Company.

PROFESSOR IRA D. REMSEN, who has occupied the chair of chemistry at the Johns Hopkins University for 25 years, since the founding of that institution, has been selected as president of the university *vice* Dr. D. C. Gilman, who has resigned. President Remsen has accepted the presidency on condition of his permission to direct the work and research of the chemical laboratory. He was born in New York in 1846. He received his degree of B. A. when 19 years old at the College of the City of New York. Two years later he was made a Doctor of Medicine at the New York College of Physicians and Surgeons. After this he went abroad to study, and in 1870 received the degree of Doctor of Philosophy at the University of Göttingen. After serving for a short time as assistant in chemistry at the University of Tuebingen, he returned to America and assumed the professorship of chemistry at Williams College, whence he came to Johns Hopkins. For his writings Dr. Remsen has the degree of LL.D. from the Columbia College and Princeton University.

Electric Railways

The Keswick, Cal., Electric Power Company is installing a power plant 40 miles southeast of Redding, with a capacity of 6,000 horse-power.

A franchise has been granted to the Columbus, Ohio, Winchester & Lancaster Railway Company, which expects to have its line in operation before the year is out.

Another electric railway is to be built between Lorain and Cleveland, Ohio. The new line will come out West Madison avenue in Cleveland and run from there to the steel plant in South Lorain.

The property and franchises of the Rutland, Vt., Street Railway in that city were sold recently to a syndicate of New York capitalists. An extension into surrounding towns is contemplated.

The Schenectady, N. Y., Railway Company has been granted a franchise by the town of Niskayuna to construct and operate a trolley line along the Troy turnpike from the limits of Schenectady to the town of Colonie.

The Washington, D. C., Traction and Electric Company has been placed in the hands of a receiver upon application filed by the United States Mortage and Trust Company, of New York. Judge Nathan Goff at Clarksburg, W. Va., on June 3 appointed Mr. Allen I. McDermott receiver.

Messrs. Joseph A. Powers and Addison B. Colvin have purchased a controlling interest in the Glens Falls, Sandy Hill & Fort Edward, N. Y., Street Railroad Company. The road is capitalized at $150,000. Mr. Colvin says that in all probability cars will be running from Waterford to Caldwell over the road by June 15.

Industrial Items

THE PERU ELECTRIC MANUFACTURING COMPANY, of Peru, Ind., reports success for its new "Baby" knife switch. The trade in general apparently approves this new switch as readily as the National Board of Fire Underwriters.

THE ELECTRIC APPLIANCE COMPANY, Chicago, is putting out a high grade bridging telephone, which is especially recommended for farmers' line work, where a low-priced, but first-class instrument is desired. Catalogue will be sent upon request.

COLONEL EZRA DE FOREST, general agent for the Penn Mutual Life Insurance Company, St. Paul Building, New York, has sent to a number of his electrical friends an aluminum mounted desk clock. It is a very convenient remembrance and is sure to be appreciated by all who receive it.

THE ELECTRIC STORAGE BATTERY COMPANY, of Philadelphia, manufacturer of the chloride accumulator, has placed the Pennsylvania sales office under the direction of Mr. E. L. Reynolds who, for a number of years, has been associated with the company in the New York office.

THE MERRITT ELECTRIC MANUFACTURING COMPANY, Middleton, Mass., is doing a large business in renewing incandescent lamps. These refilled lamps are claimed to be of three and one-half watts efficiency, operating 1,000 hours, and are guaranteed to be within one per cent of the voltage ordered.

MR. JAMES G. BIDDLE, 1024-1025 Stephen Girard Building, Philadelphia, Pa., has recently brought out a new book on cable testing apparatus. This pamphlet, while in the nature of a catalogue, also contains much information of great value upon methods of using cable testing apparatus, and is illustrated with many diagrams and views of the apparatus manufactured by Morris E. Leeds & Company, and handled by Mr. Biddle.

THE KUHLMAN ELECTRIC COMPANY, Elkhart, Ind., guarantees its transformers as to life, without any specified exceptions, relying on the good judgment of station managers in matters of installation and overloads. One of the strongest claims of this company is: "We give you what you want." A little book, tastefully prepared, telling all about the company's product, will be sent to any one interested on application to the company.

THE AMERICAN BRIDGE COMPANY, of New York, continues to fill heavy orders for structural steel, over 1,000 tons having been shipped for the use of the New York Central pier No. 59, North River, and 3,000 tons for the Illinois Central Railroad Company, which it is estimated will take care of all the bridge building that company intends to do during the coming year. The American company has the contract for all of the railroad company's bridges.

THE CENTRAL ELECTRIC COMPANY, of Chicago, is western agent for the Falcon Electric Manufacturing Company's arc lamps, fan motors, panel boards and plugs and receptacles. The Central has advertised these arc lamps and fan motors extensively and now calls attention to the panel boards and plugs and receptacles. The former are highly finished and conform to the underwriters' requirements. The latter are made in any finish and are neat, compact and durable.

THE HAINES & NOYES COMPANY, Chicago, announces that its new self-restoring telephone switchboard is now ready for the market. This board is built on the visual signal principle and is said to facilitate greatly the work of the operator while increasing its accuracy. The jack and signal are self-contained and self-restoring, and occupy a space on the front of the board of one inch by one and one-quarter inches. The board is adapted for use in hotels and private plants as well as for steerage work.

THE L. B. ALLEN COMPANY, INCORPORATED, Chicago, Ill., states that it has recently received a letter from an electrical engineer which contains the following extract: "As for the Allen commutator lubricant I will say that a glance at my commutators is enough. There is a pretty, brave gloss on them and they are as smooth as silk. I've never put sandpaper on them and positively no wear has taken place either on brushes or commutator; no sparking or heating and, in fact, I'm satisfied it's the best on the market."

THE JANDUS ELECTRIC COMPANY, Cleveland and Chicago, is placing two specialties on the market which are attracting attention; namely, the miniature enclosed arc lamp, which is said to be of unusual beauty, design and finish, and a 12-inch fan motor, direct-current, which produces an air blast said to equal that given by the ordinary 16-inch fan, and which runs at a very high efficiency. These specialties are carried in stock by the company at its Chicago office, No. 1537 Monadnock Block, Chicago, Ill.

THE EUREKA ELECTRIC COMPANY'S new No. 34 desk set is stated to be one of the finest telephone sets on the market of its kind, being a solid engine-turned brass stand and not a thin spinning. The company's new No. 20 special receiver is now ready for the market, and is being furnished on all the company's high grade telephone apparatus. This receiver is adjustable and is stated to possess special features of great excellence and utility. Full particulars and descriptive matter may be obtained by addressing the Eureka Electric Company, Chicago, Ill.

THE FORT WAYNE ELECTRIC WORKS, which was represented at the Electric Light Convention by Mr. A. E. Dresser, of Syracuse, and Mr. J. C. Lott, of New York city, is one of the busiest electrical factories in the country. The demand for the "Wood" system of arc lighting, alternating and direct-current incandescent lighting, transformers, etc., was never more pronounced than at the present time. The excellent geographical location of these works at Fort Wayne make prompt deliveries possible and the demand for the company's product under the active management of Mr. F. S. Hunting, sales manager, is constantly increasing.

MR. RAY D. LILLIBRIDGE, 20 Broad street, New York, is mailing descriptions of the Pencoyd Arch steel bridge which is built across the Niagara Gorge, accompanying the description with the new five-cent stamp of the commemorative series of 1901, which bears upon its face a reproduction of the structure. A specification of the bridge states that it was built in 1898, is 46 feet wide, carries two electric railways, two driveways, and two sidewalks, the whole consisting of two shore spans of 190 and 210 feet, and the main arch span, over the river, of 840 feet, this being the largest in the world. The total weight of the structural steel employed in the bridge is 5,050,000 pounds.

THE DE DION-BOUTON "MOTORETTE" COMPANY, Brooklyn, N. Y., employs gas engines as a source of power in the various departments of its factory. A large, twin-cylinder gas engine was installed when the factory was first equipped, over a year ago, and last week a second one of smaller size arrived, this latter engine being of 25 horsepower. The nickel-plating department has a little power plant of its own, including a three-and-one-half-horse-power, water-jacketed De Dion motor, such as drives the No. 1 New York type "Motorettes." A standard "Motorette" gasoline tank is placed above the motor, while the vaporizer occupies its usual position. The muffler pipe of steel leads outside. A copper tube of five-eighths-inch diameter connects the water jacket with the street main. The dynamo is belt-driven, its speed being 1,600 revolutions per minute. The motor runs so steadily that no equalizing device is required, the fluctuations of the dynamo current being hardly perceptible. This whole nickel-plating outfit is very interesting, as it shows a thoroughly practical application of the highly-successful De Dion motor. The De Dion works in Puteaux, France, are driven by gas engines of great power. This plant affords employment to 3,000 men.

THE ALLIS-CHALMERS COMPANY, manufacturer of heavy engines, mining and other machinery, is a corporation recently organized under the laws of New Jersey, and composed of the Edward P. Allis Company, of Milwaukee, Wis., Fraser & Chalmers, Inc., of Chicago, Gates Iron Works, of Chicago, and the Dickson Manufacturing Company, of Scranton, Pa., all of which companies have been well known in their respective fields. The E. P. Allis Company has chiefly concerned itself with the large types of Corliss engines, while the specialty of the Fraser & Chalmers Company has been mining machinery, this firm having supplied about seventy-five per cent of the machinery now used for that purpose in South Africa. The Gates Iron Works, until a few years ago, devoted its business almost exclusively to the manufacture of the Gates crusher, and the Dickson Manufacturing Company, which is in the heart of the anthracite coal district of Pennsylvania, was most intimately concerned with the development of coal mines, and has also done a large amount of business in heavy engines for electric and tramway service, being now at work on the large engines required for the new power station of the Brooklyn, N. Y., Rapid Transit Company.

THE PENNSYLVANIA RAILROAD COMPANY'S Twentieth Century passenger coaches, which have been recently introduced into the service of that road, are remarkable examples of American car building. No expense has been spared in their design and construction. The cars are 53 feet 8 inches in length, and fitted with wide vestibules, the platforms being strongly constructed and the couples of the most approved type. Saloons have been built on both ends of the cars, partitioned off from the main body by bulkheads, paneled with heavy green glass and brass grilles. A feature of interest is the operation of the windows, which are so constructed and balanced as easily to be raised by the pressure of a simple mechanism affixed to the sill. When the mechanism is pressed lightly with the finger the sash rises, stopping at any point desired by the passenger, thus doing away with the traditional difficulty of opening swollen car windows after a rain-storm, and preventing the extremes of heat or cold which have hitherto proved so annoying to passengers. One of the greatest of the modern improvements that has been introduced is the system of heating and ventilation, the cars being steam heated from the locomotive by means of a vacuum pump, thus permitting perfect regulation of temperature. The trucks are equipped with wheels 36 inches in diameter, mounted on steel axles with journals of ample dimensions. By a new design the brakes have been so arranged that the braking power is thoroughly efficient in securing a stoppage of the cars without any unpleasant sensations to the passengers, of whom 63 may find comfortable seats in these modern coaches.